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ABSTRACT

This program guide identifies primary concerns in the organization, operation, and evaluation of a computer electronics program. It is designed for local school district and community college administrators, instructors, program advisory committees, and regional coordinating councils. The guide begins with the Dictionary of Occupational Titles occupational description. A section on program content presents the curriculum framework that contains major concepts/content, laboratory activities, special note, and intended outcomes and the student performance standards that are divided into the outcomes shown in the curriculum framework. The section on program implementation addresses teacher characteristics, conventional instructional methods, student admissions criteria, student placement, cooperative education, and student organization participation. An instructional resources section lists suggested resources organized by outcome. The section on setting up classroom and laboratory facilities covers facility design recommendations and safety, maintenance, and liability. The next section lists equipment items by outcome. The last section discusses teacher technical updating and teacher standards. A list of professional organizations and support services follows. A Career Merit Achievement Plan (Career MAP) is attached. It displays the competencies required for entry into the field of computer electronics and documents the level of achievement that the student demonstrates. (KC)

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FLORIDA VOCATIONAL PROGRAM GUIDE FOR COMPUTER ELECTRONICS

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INTRODUCTION

Vocational education meets the needs of students desiring to pursue a selected vocation and is designed to provide training that is realistic in meeting present and future employment opportunities. In recent years, applications of science and technology have expanded rapidly, increasing the education and training required of workers. This has made vocational training programs more attractive as an educational option. The new technologies require well-trained workers to carry out both standardized and specialized procedures, and whose training foundation has given them the capacity to keep pace with continuing technology demands.

The Florida Department of Education shares with business and industry the determination to provide opportunities for upward mobility to as many Floridians as possible. Vocational training programs can keep pace with the demands of new industrial patterns and can provide the opportunity for many of our citizens to gain financial stability and an improved sense of self worth. Therefore, it is necessary to create exemplary vocational programs and to make those programs consistent throughout the state.

This Program Guide identifies primary concerns that should be considered in the organization, operation and evaluation of a vocational education program. It has been developed to provide useful information to local school district and community college administrators, instructors, program advisory committees, regional coordinating councils and others charged with the responsibility of offering vocational education programs.

OCCUPATIONAL DESCRIPTION

A principle occupational title is identified for each vocational training program. This title is validated by the United States Department of Labor Dictionary of Occupational Titles (DOT) or other appropriate references. Such references may be the United States Department of Commerce Standard Occupational Classification Manual (SOC), the Occupational Employment Statistics Survey Dictionary (OES), or Vocational Preparation and Occupations (VPO) prepared by the National and State Occupational Information Coordinating Committees. Information obtained from industry advisory committees may also be used to validate the principle occupational title. The job title and code number for this program are listed in the curriculum framework which accompanies this guide.

The United States Department of Labor Dictionary of Occupational Titles (D.O.T.) identifies the job title for this occupational area as follows:

D.O.T. JOB TITLE	D.O.T. CODE
Computer Service Technician	003.161-014

The definition (description) for this job title is taken from the D.O.T. for easy reference.

003.161-014 COMPUTER SERVICE TECHNICIAN.

Applies electronic theory, principles of electrical circuits, electrical testing procedures, engineering mathematics, physics and related knowledge to lay out, build, test, troubleshoot, repair and modify developmental and production electronic equipment, such as computers, missile-control instrumentation and machine tool numerical controls: Discusses layout and assembly problems with ELECTRONICS ENGINEER (profess. & kin.) and draws sketches to clarify design details and functional criteria of electronic units. Assembles experimental circuitry (breadboard) or complete prototype model according to engineering instructions, technical manuals and knowledge of electronic systems and components and their functions. Recommends changes in circuitry or installation specifications to simplify assembly and maintenance. Sets up standard test apparatus or contrives test equipment and circuitry and conducts functional, operational, environmental and life tests to evaluate performance and reliability of prototype or production model. Analyzes and interprets test data. Adjusts, calibrates, alines and modifies circuitry and components and records effects on unit performance. Writes technical reports and

develops charts, graphs and schematics to describe and illustrate systems operating characteristics, malfunctions, deviations from design specifications and functional limitations for consideration by professional engineering personnel in broader determinations affecting systems design and laboratory procedures. May operate bench lathes, drills and other machine tools to fabricate nonprocurable items, such as coils, terminal boards and chassis. May check out newly installed equipment in airplanes, ships and structures to evaluate system performance under actual operating conditions. May instruct and supervise lower grade technical personnel. May be designated according to specialization in electronic applications as COMPUTER-LABORATORY TECHNICIAN (profess. & kin.); DEVELOPMENT-INSTRUMENTATION TECHNICIAN (profess. & kin.); ELECTRONIC-COMMUNICATIONS TECHNICIAN (profess. & kin.); ELECTRONIC TECHNICIAN, NUCLEAR REACTOR (profess. & kin.); ENGINEERING-DEVELOPMENT TECHNICIAN (aircraft-aerospace mfg.); SYSTEMS-TESTING-LABORATORY TECHNICIAN (profess. & kin.).

PROGRAM CONTENT

The Division of Vocational, Adult, and Community Education, as required by State Board of Education (**S.B.E.**) **Rule 6A-6.0571**, publishes Vocational Education Program Courses Standards annually. This document specifies the minimum program content for the operation of a vocational training program for the occupational titles listed. Each program identified in the Florida Department of Education Course Code Directory is required to establish course standards. The standards for each vocational offering are comprised of two major components: (1) Curriculum Framework and (2) Student Performance Standards.

Curriculum Framework (CF)

The Curriculum Framework specifies the exact course title, course number, levels of instruction, major course content, laboratory activities, special notes, major course concepts and intended outcomes. The program requirements stipulated in the curriculum framework have been approved by the State Board of Education and are the legal bases for delivery of instruction.

Student Performance Standards (SPS)

The Student Performance Standards are a resource list of job-specific competencies. This list is generated and approved by industry experts and becomes the basis for curriculum development in vocational programs. Local school districts and community colleges must, by law, adopt student performance standards for their vocational programs. They may, at their discretion, adopt the list provided or develop their own as long as there is sufficient content to address each intended outcome. A program may provide instruction beyond the minimum specified in the SPS if desired. The decision to do this should be based on local industry needs. However, the minimum must be presented.

The SPS for secondary level programs contain a third component, course structure. This component specifies the number of courses required for program completion and the content of each course. The courses may be taught in any sequence, but the content may not be changed unless approved by the Division of Vocational, Adult, and Community Education.

The curriculum framework and student performance standards are intended for use as a guide, not a teaching tool. Teachers or curriculum development personnel are expected to develop or select complete curriculum materials for their training programs based on the curriculum framework and student performance standards. Each intended outcome and SPS should be thoroughly analyzed for related cognitive and procedural subskills. The curriculum framework and student performance standards are presented in the following pages.

CURRICULUM FRAMEWORK PROGRAM AREA: Industrial

FLORIDA DEPARTMENT OF EDUCATION EFFECTIVE DATE: July, 1989

PROGRAM TITLE: Computer Electronics

CODE NUMBER: Secondary _____ Postsecondary CTK0995

Florida CIP IN47.010400

SECONDARY SCHOOL CREDITS __ COLLEGE CREDITS ____ POSTSECONDARY ADULT VOCATIONAL CREDITS ____

APPLICABLE LEVELS(S): __ 7-9 __ 9-12 X Postsecondary Adult Vocational

__ Postsecondary Vocational X Other 30, 31

CERTIFICATION COVERAGE: COMP SVC 7 ELECTRONIC 7

I. MAJOR CONCEPTS/CONTENT: The purpose of this program is to prepare students for employment as computer service technicians (003.161-014). This program also provides supplemental training for persons previously or currently employed in this occupation.

This program includes competencies of the common core electronics program.

The course content will include the following: installation, programming, operation, maintenance and servicing of computer systems; and diagnosis and correction of operational problems in computers arising from mechanical, electrical or electronics malfunctions.

The course content should also include Principles of Work Environment Readiness (P.O.W.E.R.) skills training in communication, leadership, human relations and employability skills; and safe, efficient work practices.

II. LABORATORY ACTIVITIES: Shop or laboratory activities are an integral part of this program. These activities provide instruction in the use of tools, test equipment, materials and processes found in industry. Students will use various types of precision test equipment for analyzing, troubleshooting and repairing computer circuitry.

III. SPECIAL NOTE: The Vocational Industrial Clubs of America, Inc., is the vocational student organization which reinforces classroom instruction by providing communications, leadership, human relations and employability training experiences. It also reinforces specific vocational skills. When provided, these activities are considered an integral part of this program.

The cooperative method of instruction may be utilized for this program. When the cooperative method is offered, the following is required for each student: a training plan signed by the student,

teacher and employer which includes instructional objectives and a list of on-the-job and in-school learning experiences; and a work station which reflects equipment, skills and tasks relevant to the occupation the student has chosen as a career goal. The student must receive compensation for work performed.

Algebra is recommended as a prerequisite for entry into this program.

In accordance with Section 233.0695 F.S., the minimum basic skills grade level required for this postsecondary adult vocational program is: Mathematics 10.0, Language 9.0. This grade level number corresponds to a grade equivalent score obtained on a state designated basic skills examination.

The typical length of this program for the average achieving student is 1800 hours.

IV. INTENDED OUTCOMES: After successfully completing this program the student will be able to:

01. Demonstrate proficiency in laboratory practices.
02. Demonstrate proficiency in direct current (DC) circuits.
03. Demonstrate proficiency in alternating current (AC) circuits.
04. Demonstrate proficiency in solid-state devices.
05. Demonstrate proficiency in analog circuits.
06. Demonstrate proficiency in digital circuits.
07. Demonstrate proficiency in microprocessor systems.
08. Demonstrate proficiency in technical recording and reporting.
09. Demonstrate proficiency in computer systems architecture.
10. Demonstrate proficiency in software fundamentals.
11. Demonstrate an understanding of communication interfacing.
12. Demonstrate an understanding of peripheral equipment.
13. Demonstrate an understanding of customer site requirements and considerations.
14. Demonstrate employability skills.
15. Demonstrate an understanding of entrepreneurship.

STUDENT PERFORMANCE STANDARDS EFFECTIVE DATE: July, 1989

PROGRAM AREA: Industrial Education SECONDARY NUMBER_____

PROGRAM TITLE: Computer Electronics PROGRAM NUMBER: CTK0995

01.0 DEMONSTRATE PROFICIENCY IN LABORATORY PRACTICES--The student will be able to:

- 01.01 Apply proper Occupational Safety Health Administration (OSHA) safety standards.
- 01.02 Make electrical connections.
- 01.03 Identify and use hand tools properly.
- 01.04 Identify and use power tools properly.
- 01.05 Demonstrate acceptable soldering and desoldering techniques.

02.0 DEMONSTRATE PROFICIENCY IN DIRECT CURRENT (DC) CIRCUITS--The student will be able to:

- 02.01 Solve algebraic problems to include exponentials (prerequisite to DC).
- 02.02 Solve problems in electronic units utilizing metric prefixes.
- 02.03 Relate electricity to the nature of matter.
- 02.04 Identify sources of electricity.
- 02.05 Define voltage, current, resistance, power and energy.
- 02.06 Apply Ohm's law and power formulas.
- 02.07 Read and interpret color codes and symbols to identify electrical components and values.
- 02.08 Measure properties of a circuit using volt-ohm meter (VOM) and digital volt-ohm meter (DVM) meters and oscilloscopes.
- 02.09 Compute conductance and compute and measure resistance of conductors and insulators.
- 02.10 Apply Ohm's law to series circuits.
- 02.11 Construct and verify operation of series circuits.
- 02.12 Analyze and troubleshoot series circuits.
- 02.13 Apply Ohm's law to parallel circuits.
- 02.14 Construct and verify the operation of parallel circuits.
- 02.15 Analyze and troubleshoot parallel circuits.
- 02.16 Apply Ohm's law to series-parallel and parallel-series circuits.
- 02.17 Construct and verify the operation of series-parallel and parallel-series and bridge circuits.
- 02.18 Troubleshoot series-parallel and parallel-series and bridge circuits.
- 02.19 Identify and define voltage divider circuits (loaded and unloaded).
- 02.20 Construct and verify the operation of voltage divider circuits (loaded and unloaded).
- 02.21 Analyze and troubleshoot voltage divider circuits (loaded and unloaded).
- 02.22 Apply maximum power transfer theory.
- 02.23 Construct and verify the operation of DC circuits that demonstrate the maximum power transfer theory.
- 02.24 Describe magnetic properties of circuits and devices.
- 02.25 Determine the physical and electrical characteristics of capacitors and inductors.

02.26 Define reactive-capacitance (R-C) and inductive-reactance (R-L) time constants and classify the output of differentiators and integrators.
02.27 Setup and operate power supplies for DC circuits.

03.0 DEMONSTRATE PROFICIENCY IN ALTERNATING CURRENT (AC) CIRCUITS--The student will be able to:

03.01 Solve basic trigonometric problems as applicable to electronics (prerequisite to AC).
03.02 Identify properties of an AC signal.
03.03 Identify AC sources.
03.04 Analyze and measure AC signals utilizing VOM, DVM, oscilloscope, frequency counter and function generator.
03.05 Define the characteristics of AC capacitive circuits.
03.06 Construct and verify the operation of AC capacitive circuits.
03.07 Analyze and troubleshoot AC capacitive circuits.
03.08 Define the characteristics of AC inductive circuits.
03.09 Construct and verify the operation of AC inductive circuits.
03.10 Analyze and troubleshoot AC inductive circuits.
03.11 Define and apply the principles of transformers to AC circuits.
03.12 Construct and verify the operation of AC circuits utilizing transformers.
03.13 Analyze and troubleshoot AC circuits utilizing transformers.
03.14 Construct and verify the operation of differentiators and integrators to determine R-C and R-L time constraints.
03.15 Analyze and troubleshoot differentiator and integrator circuits.
03.16 Define the characteristics of resistance inductance capacitance (RLC) circuits (series, parallel and complex).
03.17 Construct and verify the operation of RLC circuits (series, parallel and complex).
03.18 Define the characteristics of series and parallel resonant circuits.
03.19 Construct and verify the operation of series and parallel resonant circuits.
03.20 Analyze and troubleshoot R-C, R-L and RLC circuits.
03.21 Define the characteristics of frequency selective filter circuits.
03.22 Construct and verify the operation of frequency selective filter circuits.
03.23 Analyze and troubleshoot frequency selective filter circuits.
03.24 Define the characteristics of polyphase circuits.
03.25 Define basic motor theory and operation.
03.26 Define basic generator theory and operation.
03.27 Setup and operate power supplies for AC circuits.
03.28 Analyze and measure power in AC circuits.
03.29 Setup and operate capacitor and inductor analyzers for AC circuits.

04.0 DEMONSTRATE PROFICIENCY IN SOLID-STATE DEVICES--The student will be able to:

04.01 Identify and define properties of semiconductor materials.
04.02 Identify and define operating characteristics and applications of junction diodes.

04.03 Identify and define operating characteristics and application of special diodes.
04.04 Construct diode circuits.
04.05 Analyze and troubleshoot diode circuits.
04.06 Identify and define operating characteristics and applications of bipolar transistors.
04.07 Identify and define operating characteristics and applications of field effect transistors.
04.08 Identify and define operating characteristics and applications of single-stage amplifiers.
04.09 Construct single-stage amplifiers.
04.10 Analyze and troubleshoot single-stage amplifiers.
04.11 Construct thyristor circuitry.
04.12 Analyze and troubleshoot thyristor circuitry.
04.13 Setup and operate a VOM for solid-state devices.
04.14 Setup and operate a DVM for solid-state devices.
04.15 Setup and operate power supplies for solid-state devices.
04.16 Setup and operate oscilloscopes for solid-state devices.
04.17 Setup and operate function generators for solid-state devices.
04.18 Setup and operate capacitor and inductor analyzers for solid-state devices.
04.19 Setup and operate curve tracers.
04.20 Setup and operate transistor testers.

05.0 DEMONSTRATE PROFICIENCY IN ANALOG CIRCUITS--The student will be able to:

05.01 Identify and define operational characteristics and applications of multistage amplifiers.
05.02 Construct multistage amplifiers.
05.03 Analyze and troubleshoot multistage amplifiers.
05.04 Identify and define operating characteristics and applications of linear integrated circuits.
05.05 Identify and define operating characteristics and applications of basic power supplies and filters.
05.06 Construct basic power supplies and filters.
05.07 Troubleshoot basic power supplies and filters.
05.08 Identify and define operating characteristics and applications of differential and operational amplifiers.
05.09 Construct differential and operational amplifier circuits.
05.10 Analyze and troubleshoot differential and operational amplifier circuits.
05.11 Identify and define operating characteristics of audio power amplifiers.
05.12 Construct audio power amplifiers.
05.13 Analyze and troubleshoot audio power amplifiers.
05.14 Identify and define operating characteristics and applications of power supply regulator circuits.
05.15 Construct power supply regulator circuits.
05.16 Analyze and troubleshoot power supply regulator circuits.
05.17 Identify and define operating characteristics and applications of active filters.
05.18 Construct active filter circuits.
05.19 Analyze and troubleshoot active filter circuits.
05.20 Identify and define operating characteristics and applications of sinusoidal and nonsinusoidal oscillator circuits.
05.21 Construct oscillator circuits.

05.22 Analyze and troubleshoot oscillator circuits.
05.23 Identify and define operating characteristics and applications of motor phase-shift control circuits (single-phase and multiphase).
05.24 Identify and define operating characteristics and applications of cathode ray tubes.
05.25 Identify and define operating characteristics and applications of optoelectronic devices.
05.26 Setup and operate measuring instruments for analog circuits.

06.0 DEMONSTRATE PROFICIENCY IN DIGITAL CIRCUITS--The student will be able to:

06.01 Define and apply numbering systems to codes and arithmetic operations.
06.02 Analyze and minimize logic circuits using Boolean operations.
06.03 Setup and operate logic probes for digital circuits.
06.04 Setup and operate power supplies for digital circuits and solve power distribution and noise problems.
06.05 Setup and operate pulsers for digital circuits.
06.06 Setup and operate oscilloscopes for digital circuits.
06.07 Setup and operate logic analyzers for digital circuits.
06.08 Setup and operate pulse generators for digital circuits.
06.09 Identify types of logic gates and their truth tables.
06.10 Construct combinational logic circuits using integrated circuits.
06.11 Troubleshoot logic circuits.
06.12 Analyze types of flip-flops and their truth tables.
06.13 Construct flip-flops using integrated circuits.
06.14 Troubleshoot flip-flops.
06.15 Identify, define and measure characteristics of integrated circuit (IC) logic families.
06.16 Identify types of registers and counters.
06.17 Construct registers and counters using flip-flops and logic gates.
06.18 Troubleshoot registers and counters.
06.19 Analyze clock and timing circuits.
06.20 Construct clock and timing circuits.
06.21 Troubleshoot clock and timing circuits.
06.22 Identify types of arithmetic-logic circuits.
06.23 Construct arithmetic-logic circuits.
06.24 Troubleshoot arithmetic-logic circuits.
06.25 Identify types of encoding and decoding devices.
06.26 Construct encoders and decoders.
06.27 Troubleshoot encoders and decoders.
06.28 Identify types of multiplexer and demultiplexer circuits.
06.29 Construct multiplexer and demultiplexer circuits using integrated circuits.
06.30 Troubleshoot multiplexer and demultiplexer circuits.
06.31 Identify types of memory circuits.
06.32 Relate the uses of digital-to-analog and analog-to-digital conversions.
06.33 Construct digital-to-analog and analog-to-digital circuits.
06.34 Troubleshoot digital-to-analog and analog-to-digital circuits.
06.35 Identify types of digital displays.
06.36 Construct digital display circuits.
06.37 Troubleshoot digital display circuits.

07.0 DEMONSTRATE PROFICIENCY IN MICROPROCESSOR SYSTEMS--The student will be able to:

- 07.01 Identify central processing unit (CPU) building blocks and their uses (architecture).
- 07.02 Analyze bus concepts.
- 07.03 Analyze various memory schemes.
- 07.04 Use memory devices in circuits.
- 07.05 Troubleshoot memory device circuits.
- 07.06 Setup and operate oscilloscopes for microprocessor systems.
- 07.07 Setup and operate logic-data analyzers for troubleshooting microprocessor systems.
- 07.08 Identify types of input and output devices and peripherals.
- 07.09 Interface input and output ports to peripherals.
- 07.10 Analyze and troubleshoot input and output ports.
- 07.11 Execute computer instruction sets.

08.0 DEMONSTRATE PROFICIENCY IN TECHNICAL RECORDING AND REPORTING--The student will be able to:

- 08.01 Draw and interpret electronic schematics.
- 08.02 Record data and design curves and graphs.
- 08.03 Write reports and make oral presentations.
- 08.04 Maintain test logs.
- 08.05 Make equipment failure reports.
- 08.06 Specify and requisition simple electronic components.
- 08.07 Compose technical letters and memoranda.
- 08.08 Write formal reports of laboratory experiences.
- 08.09 Draft preventive maintenance and calibration procedures.

09.0 DEMONSTRATE PROFICIENCY IN COMPUTER SYSTEMS ARCHITECTURE--The student will be able to:

- 09.01 Draw and explain systems configurations in block detail.
- 09.02 Interpret computer acronyms.
- 09.03 Identify and define priorities and interrupts at system level.
- 09.04 Define and list direct memory access handling systems.
- 09.05 Define functions of advanced memory techniques (virtual, pipeline, cache).
- 09.06 Troubleshoot a microcomputer system.

10.0 DEMONSTRATE PROFICIENCY IN SOFTWARE FUNDAMENTALS--The student will be able to:

- 10.01 Load and run operating system software.
- 10.02 Load and run diagnostic software.
- 10.03 Construct flow charts.
- 10.04 Analyze flow charts.
- 10.05 Identify and define computer languages and their uses.
- 10.06 Write a simple computer program in BASIC.
- 10.07 Write a computer program in assembly language.
- 10.08 Write a computer program in machine language.
- 10.09 Analyze firmware concepts.

10.10 Troubleshoot firmware using defined hardware.
10.11 Analyze firmware writing concepts.

11.0 DEMONSTRATE AN UNDERSTANDING OF COMMUNICATION INTERFACING--The student will be able to:

11.01 Identify and define EIA, IEEE and CCITT standards.
11.02 Identify, define and analyze sync devices.
11.03 Identify, define and analyze async devices.
11.04 Identify and define networking levels or layers.
11.05 Identify and define protocols.
11.06 Identify and define packet switching.
11.07 Identify and define multiuser systems.

12.0 DEMONSTRATE AN UNDERSTANDING OF PERIPHERAL EQUIPMENT --The student will be able to:

12.01 Identify types of card and paper-tape equipment and interface controllers.
12.02 Analyze and troubleshoot display terminals and interface controllers.
12.03 Analyze and troubleshoot printers and interface controllers.
12.04 Align printers and interface controllers.
12.05 Describe the operation of typical magnetic tape equipment and interface controllers.
12.06 Analyze disk equipment and interface controllers.
12.07 Troubleshoot and repair disk equipment and interface controllers.
12.08 Align disk equipment and interface controllers.
12.09 Define environmental requirements for peripherals and media.

13.0 DEMONSTRATE AN UNDERSTANDING OF CUSTOMER SITE REQUIREMENTS AND CONSIDERATIONS--The student will be able to:

13.01 Apply effective relations.
13.02 Follow installation procedures.
13.03 Cálculate and determine power requirements.
13.04 Calculate and determine environmental requirements.
13.05 List and perform preventative maintenance techniques and requirements.

14.0 DEMONSTRATE EMPLOYABILITY SKILLS--The student will be able to:

14.01 Conduct a job search.
14.02 Secure information about a job.
14.03 Identify documents that may be required when applying for a job.
14.04 Complete a job application form correctly.
14.05 Demonstrate competence in job interview techniques.
14.06 Identify or demonstrate appropriate responses to criticism from employer, supervisor or other persons.
14.07 Identify acceptable work habits.

14.08 Demonstrate knowledge of how to make job changes appropriately.
14.09 Demonstrate acceptable employee health habits.

15.0 DEMONSTRATE AN UNDERSTANDING OF ENTREPRENEURSHIP--
The student will be able to:

15.01 Define entrepreneurship.
15.02 Describe the importance of entrepreneurship to the American economy.
15.03 List the advantages and disadvantages of business ownership.
15.04 Identify the risks involved in ownership of a business.
15.05 Identify the necessary personal characteristics of a successful entrepreneur.
15.06 Identify the business skills needed to operate a small business efficiently and effectively.

PROGRAM IMPLEMENTATION

It is the teacher's responsibility to ensure that students learn how to competently perform the tasks specified in the course objectives. Therefore, the teacher must lead the students through the learning experiences in a course, motivate students, act as a role model for students and, at times, function as a guidance counselor and placement coordinator. This leadership role requires the teacher to participate in many of the activities required for program implementation. The teacher must select the methods of instruction that best apply to students' ability levels, measure student achievement and provide feedback. Key factors that must be considered when implementing this program are addressed below.

TEACHER CHARACTERISTICS

Subject Knowledge

The teacher must be a subject matter expert who is able to implement sound instructional methods and evaluate student performance. He/she must have significant work experience in the industry/vocational field and be able to communicate that knowledge to the students.

Instructional Delivery

The teacher's role in the learning process is to motivate and lead the student as well as impart subject matter knowledge. In order to maximize student learning, the use of a variety of instructional methods is encouraged. Because teaching styles vary greatly, teachers are highly encouraged to "pick and choose" from various methods or to combine methods for maximum benefit to students. Some of the more traditional methods used are lecture, demonstration and small group instruction. Other teaching methods which are suggested for further exploration include individualized self-paced, open-exit/open-entry, contract, computer based and competency based instruction. The focus of Competency Based Vocational Education (CBVE) is to ensure that each student can competently perform tasks specified before progressing to more complex skills.

CONVENTIONAL INSTRUCTIONAL METHODS

A vocational program may require a portion of the instruction to be presented in a standard lecture or controlled demonstration format. These methods of instruction can be easily combined with instructor controlled step-by-step practical exercises. Some instructional activities may dictate that this instructional approach be used to introduce students to hazardous equipment often utilized in vocational training. In most situations, students should be required to perform specified activities to achieve maximum skill competency. If mastery of a task is required, competency based education methods may be more appropriate. However, if the training activity involves an orientation or a seldom performed, non-essential task, conventional instructional methods may be more effective. Teachers are encouraged to use a variety of instructional methods to best meet instructional objectives.

Instructional Development

Teachers often must develop and select their own teaching and curriculum materials. In developing a comprehensive curriculum, instructional objectives based upon both the performance and cognitive domain must be included. When developing curriculum materials, teachers must use the curriculum framework (CF) and student performance standards (SPS) contained in this program guide as a basis. These materials delineate minimum program content which must be presented for an approved vocational training program. However, they are not intended for use as a comprehensive curriculum. Be certain not to adapt the curriculum to available materials, but select only those materials which can be adapted to the curriculum.

Instructional Measurement

Teachers must select testing methods that support the instructional delivery system used. Teachers must be competent to develop, administer and evaluate written and performance type tests.

Student Admissions Criteria

Providing the student the opportunity to successfully complete a vocational education program, in any institution, should be the primary concern of the instructional effort. Therefore, it is very important to direct planning and effort into identifying and selecting students with excellent potential for success in the educational program and in the occupation. The school's primary task is to prepare people for fulltime, entry-level positions as technicians or, in the case of those with more experience, as managers.

The Course Code Directory, specifies grade levels at which occupational programs are offered. Specific student admissions criteria which is required by the State and local educational agencies for the Computer Electronics training program is illustrated as follows.

SPECIFIC ADMISSIONS CRITERIA

Minimum Age:	As required by state and local policy
Physical Requirements:	None
Special Requirements:	None
Minimum Basic Skills Math Level:	* 10.0
Minimum Basic Skills Language Level:	* 9.0

* This grade level requirement is specified in the Curriculum Framework and is applicable to postsecondary level programs of 450 hours or more only. There is no minimum basic skill requirement for secondary programs.

THE STUDENT PROFILE

Developing a student profile is an important step in program implementation. Attention should focus on student characteristics that can be remediated within a training program, but could create serious impediments to success in the vocational field. Typical of these would be deficiencies in communications and mathematical skills. The basic skill levels can be measured by testing. Test results can then be used to direct the student to more suitable training which matches his or her skill level, or to determine supplemental training which may be required to increase chances for student success.

High school and postsecondary vocational students can be admitted to a vocational program upon request if they meet any specified prerequisites, such as physical or basic skill requirements. Training programs should be accessible to as many students as possible. Training programs are designed to prepare students for employment upon graduation, or serve as prerequisite to a postsecondary program.

The community college can be more selective and establish stringent admission standards. This may be done by assessing applicants or by recruiting potential students who meet the established prerequisite requirements of the training. The program advisory committee can design a profile of the potentially successful student. The profile should contain a

list of qualities, traits and aptitudes that will indicate a higher potential for student success. Acceptable levels for these traits must also be determined. For example, the qualities deserving highest attention, mechanical ability and cognitive aptitude, are those which the educational program itself will not likely be able to influence, although these traits should have considerable weight in establishing the basic profile. Deficiencies in mathematical or communications skills may lend themselves to improvement through related instruction while the student is enrolled in the program. The following example illustrates specific qualities to consider when establishing the student profile:

Mechanic/Technician--Service

- Knowledge of basic tools and equipment used by mechanics/technicians
- Ability to analyze and solve mechanical and technical problems
- Ability to interpret written mechanical/technical materials
- Ability to interpret mechanical/technical drawings
- Mechanical dexterity

Mechanic/Technical Service Management

- Basic application of service
- Business skills
- Ability to work with people
- Communications skills
- Leadership

QUALIFYING AND PRETESTING

Assessing potential students for vocational programs is an integral part of the recruiting process since considerable amounts of time and money will be spent on students entering training. Recruiters must have a good idea of the candidate's basic aptitude. Whoever guides the candidate to the program needs to have knowledge of the student's interests, abilities and experience. These can be measured by a variety of assessment methods, which should be performed upon program entry. The assessment can help determine extent and level of training each individual should receive.

Assessment should determine the level at which the student can read, write, calculate mathmatics and understand the English language. It is appropriate for the program advisory committee and the school to develop some selection criteria based on minimum skill levels. These criteria should remain flexible in order to maximize educational opportunity for all applicants. Additionally, vocational educators must make every effort to serve the variety of "special needs" students and to eliminate sex-bias and stereotyping in all occupational areas.

ADVISORY COMMITTEE

It is imperative that representatives of industry be organized into an advisory committee. Constantly changing technological demands of our society will continue to stimulate changing industrial patterns. Therefore, effective use of program advisory committees is vital to the successful implementation of vocational training programs. Advisory committees provide expert technical advice which is not easily obtainable elsewhere, offer external support of policies and have tremendous public relations potential.

The most effective advisory committees are those whose members have mutual respect for each other's abilities and vested interest in the training program because of their need for trained workers. The program advisory committee is also one of the most effective means of facilitating placement. Its role can be:

- To contact local industry and encourage them to use the school's placement office as a means of filling jobs
- To develop an effective procedure for interviewing and evaluating potential employees suggested by the school
- To assist in gathering accurate and current job information as it becomes available

COUNSELING AND GUIDANCE

Counseling of students serves two purposes. It guides the student into the program and it supports enrolled students on a continuing basis throughout the program. Much day-to-day counseling will be the responsibility of the teacher. The teacher has the most contact with the student and is in a position to detect and correct a problem. Each student will encounter new problems as the program develops. The teacher's job is to work with the student to help identify problems and then strive for solutions. The teacher will provide much of the counseling that focuses on trade knowledge and skills.

The professional counselor cannot be expected to have the subject matter expertise of the primary teacher. The counselor, however, can focus on the student's needs related to other issues such as personal growth, interests and attitudes. The ideal situation will provide at least one counselor with current knowledge of industry standards for career counseling. A useful tool which should be used in the counseling process is the Career Merit Achievement Plan (Career MAP) which presents minimum instructional content keyed to student performance standards. Career MAPs are available for each industrial program area, and can be used to document student achievement, isolate student interests, talents and weaknesses. They are also useful for placement purposes. Information on Career MAPs may be obtained by contacting the Department of Education, Division of Vocational, Adult, and Community Education, (904) 488-0484.

STUDENT PLACEMENT

Implementing an effective placement system is integral to developing a successful vocational training program. **S.B.E. Rule 229.551 (3)(g)** requires 70 percent placement of students who have completed a vocational training program. Although placement is not always a problem, as with students already working in a related occupation, the placement program should place emphasis upon students who are seeking entry-level employment since these students have little or no experience with industry.

The task of the placement program is to locate job openings in the community. The placement coordinator or teacher must know each student's personal aims and interests in addition to the information stated on the achievement record. In many cases, teachers are the best source to match students to job openings because of their contacts with the industry advisory committee. Input concerning employment openings must come from individual business establishments in the community. The placement coordinator should introduce a student to as many suitable job openings as possible. Conversely, employers can then be expected to interview as many qualified candidates as possible.

Cooperative Education

COOPERATIVE EDUCATION APPLICABILITY

Normally, students will complete the entire program as full-time students before obtaining employment. However, there may be situations where students could be allowed to complete part of the program while employed in their occupational areas. At this time it is appropriate for the student to enroll in industrial cooperative education (ICE). Guidelines for this training plan are provided in the "Industrial Cooperative Education Program Guide," published by the Division of Vocational, Adult, and Community Education, Order # IE 508 BK 87.

Industrial cooperative education is a method of instruction designed to prepare students for jobs in the community. This method is a joint effort between the school and the business community. Student trainees receive a combination of instruction in the classroom and related on-the-job training through employment. Learning experiences are jointly planned and supervised by the teacher and the employer. Cooperative education is relevant to the needs of the student preparing for a work role, and will help the student to achieve success and personal satisfaction as the transition is made from school to the constantly changing world of work.

Cooperative education is defined in the Federal Register, Volume 39, number 143, Vocational Education, Section 102.96, as a program ". . . to prepare students for employment, through: (a) providing meaningful work experiences combined with formal education enabling students to acquire knowledge, skills, and appropriate attitudes, (b) removing the artificial barriers which separate work and education, (c) involving educators with employers, creating interaction whereby the needs and problems of both are made known, thereby making it possible for occupational curricula to be revised to reflect current needs in various occupations . . . ."

PURPOSE

Cooperative Education is for persons who, through written cooperative arrangements between the school and employers, receive instruction, including required academic courses and related instruction by alternation of study in school with a job in any industrial occupational field. These two experiences must be planned and supervised by the school and employers so that each contributes to the student's education and employability. Work periods and school attendance may be on alternative half days, full days, weeks or other periods of time to fulfill objectives of the cooperative education program.

GOALS AND OBJECTIVES

The primary goal of the cooperative method of vocational education is to prepare skilled, responsible individuals who can assume a productive role in the community. Specific objectives to meet the primary goal are:

- To prepare individuals for employment, adjustment and advancement in specified occupations or occupational areas (primary objective)
- To provide an understanding of the contribution of work to the social and economic welfare of our nation
- To provide students with an understanding and appreciation of the American free enterprise system
- To foster an awareness of the civic, social and moral responsibilities of individuals to society

- To stimulate students' interest in their chosen occupational fields and provide an understanding of the opportunities in each field
- To provide training that results in increased efficiency in performing job tasks
- To provide curriculum which is sensitive and adaptable to changes in occupational practices and procedures as they are affected by societal, economic, technical and educational developments
- To strive to develop a greater appreciation of the value of specifically trained personnel among employers, employees and consumers
- To reinforce skills learned in the school laboratory
- To provide experiences on tools and equipment not available in the school laboratory
- To supplement and broaden the school curriculum into areas not otherwise available

Student Organization Participation

Vocational student organizations operate pursuant to federal and state laws, which authorize them as viable components of vocational education programs. According to federal regulations, the vocational education program of instruction may include activities of vocational student organizations which are an integral part of the vocational instruction offered and which are supervised by vocational education personnel. The **S.B.E.** Rules authorize vocational student organizations as an integral part of the vocational education program as stated in **S.B.E. 6A-6.064 (7)** and **6A-6.065 (8).**

VOCATIONAL INDUSTRIAL CLUBS OF AMERICA (VICA)

VICA is an organization for secondary or postsecondary students enrolled in trade and industrial education programs in high schools, area vocational technical centers and junior and community colleges. It is the only national and international organization for trade and industrial students. The organization is designed to expand and enrich opportunities for leadership, social awareness and civic responsibility in vocational students.

Students who participate in VICA activities are often better prepared for the world of work. They acquire knowledge of the many opportunities available in their chosen careers and become aware of the value of their

contributions to society. They are also given opportunities to develop and utilize their talents and abilities in ways that otherwise would not be available to them.

BENEFITS OF VICA MEMBERSHIP FOR THE STUDENT

Membership in VICA offers the student the opportunity for growth and development in the following areas:

School and Community Service Activities Students in VICA become involved in various school and/or community services. These may include clothing or food collections for the needy, donation of time and service to the elderly and participation in fund raisers or similar activities.

Social Interaction with Fellow Students Activities are also available that offer students time for relaxation and fun. Social activities of this type may be held on a regular basis. They might be held on the school campus during school hours, or off campus after school. More formal functions would include end of the year award banquets or industry/employer appreciation dinner banquets.

Competition in Skill and Leadership Contests VICA offers various contests in all the skill and leadership areas it serves. Often, teachers identify talented students who represent their school in regional competitions. However, any student member of VICA may compete. Instructors should conduct planned contests within their trade areas. This also pertains to leadership areas. First and second place regional winners then move on to the state level contest. The state winners then compete at the national level of the United States Skill Olympics.

INSTRUCTIONAL RESOURCES

STUDENT REFERENCE MATERIALS

Necessary instructional texts or pertinent material should be available for each student to satisfy training objectives. When textbooks are used, the copyright date should be as current as possible.

SERVICE MANUALS

Manuals with current manufacturer's service procedures and specifications should be available. These manuals must be located where students can use them while working in the shop area.

PERIODICALS

Current general and technical magazines and newspapers should be available for student and instructor use.

The following list of suggested resources is organized under each outcome shown in the curriculum framework. These resources have been recommended by instructors and program administrators through statewide surveys.

01.0 DEMONSTRATE PROFICIENCY IN LABORATORY PRACTICES

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
High Reliability Interconnection Technology PACE Technical Education and Training 5050-0082	PACE, INC.	text
Rework and Repair for Electronics, Repair of Printed Circuit Boards	PACE, INC.	text

02.0 DEMONSTRATE PROFICIENCY IN DIRECT CURRENT (DC) CIRCUITS

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
Basic Electronics Grob	McGRAW HILL BOOK COMPANY	text
Electronic Circuits Fundamentals Floyd	MERRILL PUBLISHERS	text

03.0 DEMONSTRATE PROFICIENCY IN ALTERNATING CURRENT (AC) CIRCUITS

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
NONE		

04.0 DEMONSTRATE PROFICIENCY IN SOLID-STATE DEVICES

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
Electronic Devices Floyd	MERRILL PUBLISHERS	text

05.0 DEMONSTRATE PROFICIENCY IN ANALOG CIRCUITS

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
NONE		

06.0 DEMONSTRATE PROFICIENCY IN DIGITAL CIRCUITS

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
Digital Electronics Tokheim	McGRAW HILL BOOK COMPANY	text
Digital Fundamentals Floyd	MERRILL PUBLISHERS	text

07.0 DEMONSTRATE PROFICIENCY IN MICROPROCESSOR SYSTEMS

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
Microprocessor Architecture, Programming and Applications with the 8085/8080A Gaonkar	MERRILL PUBLISHERS	text
The 8085A Microprocessor Software, Programming and Architecture Brey	PRENTICE-HALL MEDIA	text

08.0 DEMONSTRATE PROFICIENCY IN TECHNICAL RECORDING AND REPORTING

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
NONE		

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09.0 DEMONSTRATE PROFICIENCY IN COMPUTER SYSTEMS ARCHITECTURE

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
Computerfacts (for all computer areas) Robert C. Brenner	HOWARD W. SAMS AND COMPANY, Division of Macmillan, Inc.	text
IBM PC Advanced Troubleshooting and Repair Guide Robert C. Brenner	HOWARD W. SAMS AND COMPANY, Division of Macmillan, Inc.	text
IBM PC Troubleshooting and Repair Guide Robert C. Brenner	HOWARD W. SAMS AND COMPANY, Division of Macmillan, Inc.	text
Microcomputer Hardware Operation and Troubleshooting	McGRAW HILL BOOK COMPANY	text
Microcomputer Hardware, Operator, and Troubleshooting with IBM PC Applications Byron W. Putman ISBN#0-13	PRENTICE-HALL, Division of Simon & Schuster	text
Microcomputer Troubleshooting James Perozzo ISBN#0-827	DELMAR PUBLISHING	text
Small Computer Theory and Applications Dailey	McGRAW HILL BOOK COMPANY	text
Troubleshooting IBM PC's and Clones	CHILTON BOOK COMPANY	text

10.0 DEMONSTRATE PROFICIENCY IN SOFTWARE FUNDAMENTALS

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
Computers and Computer Languages Silverman and Turkiew	McGRAW HILL BOOK COMPANY	text

Discovering MS-DOS Kate O'Day ISBN#0-672	HOWARD W. SAMS AND COMPANY, Division of Macmillan, Inc.	text
Learning Assembly Language Heath	HEATH COMPANY	text
MS-DOS Heath	HEATH COMPANY	text
MS-DOS Handbook	McGRAW HILL BOOK COMPANY	text
PC-DOS Tips and Traps	McGRAW HILL BOOK COMPANY	text

11.0 DEMONSTRATE AN UNDERSTANDING OF COMMUNICATION INTERFACING

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
Data Communications Schweber	McGRAW HILL BOOK COMPANY	text
Data Communications	PRENTICE-HALL, Division of Simon & Schuster	text
The Local Area Network Book E. G. Brooner ISBN#0-672	HOWARD W. SAMS AND COMPANY, Division of Macmillan, Inc.	text

12.0 DEMONSTRATE AN UNDERSTANDING OF PERIPHERAL EQUIPMENT

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
IBM PC Peripheral Troubleshooting and Repair Charles J. Brooks ISBN#0-672	HOWARD W. SAMS AND COMPANY, Division of Macmillan, Inc.	text
Microcomputer Hardware Operation and Troubleshooting	McGRAW HILL BOOK COMPANY	text

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13.0 DEMONSTRATE AN UNDERSTANDING OF CUSTOMER SITE REQUIREMENTS AND CONSIDERATIONS

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
Microcomputer Troubleshooting Heath	HEATH COMPANY DIVISION	text

14.0 DEMONSTRATE EMPLOYABILITY SKILLS

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
Applying for a Job - Instructor's Guide (CE 004 BK 81)	FLORIDA DEPARTMENT OF EDUCATION, DIVISION OF VOCATIONAL EDUCATION	instructor text
Choosing an Occupation - Instructor's Guide (CE 010 BK 84)	FLORIDA DEPARTMENT OF EDUCATION, DIVISION OF VOCATIONAL EDUCATION	instructor text
Employability Skills Leader's Guide: In-service Workshop (CE 205 BK 85)	FLORIDA DEPARTMENT OF EDUCATION, DIVISION OF VOCATIONAL EDUCATION	instructor text
Good Work - Instructor's Guide (CE 018 BK 84)	FLORIDA DEPARTMENT OF EDUCATION, DIVISION OF VOCATIONAL EDUCATION	instructor text
Job Changes - Instructor's Guide (CE 025 BK 84)	FLORIDA DEPARTMENT OF EDUCATION, DIVISION OF VOCATIONAL EDUCATION	instructor text
Personal Finances - Instructor's Guide (CE 030 BK 84)	FLORIDA DEPARTMENT OF EDUCATION, DIVISION OF VOCATIONAL EDUCATION	instructor text

Your Job Search - Instructor's Guide (CE 038 BK 84)	FLORIDA DEPARTMENT OF EDUCATION, DIVISION OF VOCATIONAL EDUCATION	instructor text
Employability Skills Series (ESS) (CE 001 SS 81)	FLORIDA DEPARTMENT OF EDUCATION, DIVISION OF VOCATIONAL EDUCATION	module
Applying for a Job - Student Guide (CE 003 BK 79)	FLORIDA DEPARTMENT OF EDUCATION, DIVISION OF VOCATIONAL EDUCATION	student text
Choosing an Occupation - Student Guide (CE 009 BK 84)	FLORIDA DEPARTMENT OF EDUCATION, DIVISION OF VOCATIONAL EDUCATION	student text
Employability Skills Participant's Guide: In-service Workshop (CE 074 BK 84)	FLORIDA DEPARTMENT OF EDUCATION, DIVISION OF VOCATIONAL EDUCATION	student text
Good Work - Student Guide (CE 017 BK 84)	FLORIDA DEPARTMENT OF EDUCATION, DIVISION OF VOCATIONAL EDUCATION	student text
Job Changes - Student Guide (CE 024 BK 84)	FLORIDA DEPARTMENT OF EDUCATION, DIVISION OF VOCATIONAL EDUCATION	student text
Personal Finances - Student Guide (CE 029 BK 83)	FLORIDA DEPARTMENT OF EDUCATION, DIVISION OF VOCATIONAL EDUCATION	student text
Your Job Search - Student Guide (CE 037 BK 84)	FLORIDA DEPARTMENT OF EDUCATION, DIVISION OF VOCATIONAL EDUCATION	student text
A Guide to Employability Skills Materials (CE 042 BK 85)	FLORIDA DEPARTMENT OF EDUCATION, DIVISION OF VOCATIONAL EDUCATION	text

ESS for Success (CD 150 BK 84)	FLORIDA DEPARTMENT OF EDUCATION, DIVISION OF VOCATIONAL EDUCATION	text

15.0 DEMONSTRATE AN UNDERSTANDING OF ENTREPRENEURSHIP

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
Starting and Operating a Business in Florida Michael D. Jenkins and Jonathan H. Warner ISBN#0-916	OASIS PRESS	text

PUBLISHERS' ADDRESSES

CHILTON BOOK COMPANY
Chilton Way
Radnor, PA 19089
215-964-4000

DELMAR PUBLISHING
2 Computer Drive West
Albany, NY 12212
518-459-1150

FLORIDA DEPARTMENT OF EDUCATION, DIVISION OF VOCATIONAL EDUCATION
Knott Building
Tallahassee, FL 32399

HEATH COMPANY
Post Office Box 1288
Benton Harbor, MI 49022
800-253-0570

HOWARD W. SAMS AND COMPANY
Division of MacMillan, Inc.
4300 W. 62nd Street
Indianapolis, IN 46268
800-428-7267

MERRILL PUBLISHERS
1300 Alum Creek Drive
Columbus, OH 43216
800-848-6205

McGRAW HILL BOOK COMPANY
1221 Avenue of the Americas
New York, NY 10020
212-512-2000

OASIS PRESS
720 South Hillview Drive
Milpitas, CA 95035
408-263-9671

PACE, INC.
9893 Brewers Court
Laurel, MD 20707

PRENTICE-HALL MEDIA
90 South Bedford Road
Mt. Kisco, NY 10549
914-631-8300

PRENTICE-HALL
Division of Simon & Schuster
Route 9 West
Englewood Cliffs, NJ 07632
201-592-2000

FACILITIES

Facility Design Recommendations

Facilities, tools and equipment are essential parts of training programs, and must be designed to meet State program standard requirements and instructional objectives. This section of the Program Guide contains information for setting up classroom and laboratory facilities. Facility design criteria and space requirements are specified in **S.B.E. Section B, Chapter 6A-2.**

TEACHING FACILITIES

The instructional environment should duplicate, as closely as possible, the real-life work environment the student will enter after graduation. The more the school resembles the industrial environment, the easier it will be for the student to make the transition from school to work. Tools, supplies and equipment should conform to local industry standards. The teacher should actively pursue supplemental resources to expose the students to s' ıte-of-the-art equipment.

All facilities should include classroom space, as well as space for regular classroom equipment such as audio-visual equipment. Laboratory facilities should be equipped with work stations or workbenches, tables, chairs and special training aids to demonstrate basic principles and theory. They should contain enough tools and equipment to enable several students to work individually on the same learning activity.

UPDATING FACILITIES

To keep pace with technological changes and improvements, facilities must be updated on a continuing basis. When planning facilities, priority must be to provide space which will fulfill changing needs of the instructional program. Buildings should be designed with flexibility to expand in order to accomodate future program changes and to allow for greater ease of facility updating. The program advisory committee should be used to assist the school in establishing priorities for obtaining facilities, tools and equipment. Careful planning and analysis of current and future needs will lead to the establishment of an effective training environment.

SCHOOL FACILITIES

Computer Electronics Classroom/Laboratory Areas

This section of the program guide provides guidelines for Computer Electronics program facilities. All vocational programs must meet additional requirements specified in **S.B.E. Section B, Chapter 6 A-2.**

The classroom/laboratory areas should include sufficient student work stations. Each work station should be equipped with special lighting, as necessary. The work stations should provide shelving on which test equipment will be placed. The shelving should be above or adjacent to the bench work area.

The laboratory should include electrical outlets providing 110 volts at each work station. Electrical outlets should be permanently mounted to the work station benches. Additional electrical outlets should be installed along the walls and in the center areas of the laboratory. Electrical outlets in the center areas should be mounted on posts between the ceiling and work stations or on pull down extension systems. Special electrical wiring may be required to supply power requirements of specialized equipment. All electrical service must be installed according to local building code requirements.

CLASSROOM/LABORATORY FACILITIES

Space requirements for **new** facility construction for this program are specified in **S.B.E. Rule 6A-2.032** as shown below.

NEW FACILITIES
COMPUTER ELECTRONICS

Occupant Design Stations	20
Net Square Feet Per Occupant	
Minimum	72
Normal	76
Maximum	79
Total Net Square Feet	
Minimum	1440
Normal	1520
Maximum	1580

WORK STATION ARRANGEMENT

The arrangement of work stations and specialized equipment depends upon the general layout of the facilities, but careful consideration must be given to convenience to entrances and exits, easy movement among work stations and tool/storage areas. The area should have a counter convenient to work stations. Overall layout of the facility should be planned so that the location of entrances and exits permits a logical flow of work in progress. One of the most critical factors in planning a facility is the arrangement of work stations to obtain a safe, efficient traffic pattern.

ADDITIONAL FACILITY CONSIDERATIONS

Training Stations

Training stations and live work areas must be available in the type and number required to meet program goals and performance objectives.

Instructional Area

A classroom or designated area of the laboratory should be available for lecture, instruction, viewing audio visual materials and other nonshop activities.

Personal Tool/Equipment Storage Area

A secure storage room or area should be provided, with enough shelf space for student supplies/tool boxes and floor space for equipment.

General Storage

Storage areas for tools, parts, supplies and machines must be sufficient to support the activities outlined in the program goals and performance objectives.

Office Space

An area separate from the classroom and laboratory should be available and convenient for use by the instructor(s) as an ofice.

Maintenance

A regular facilities maintenance program must be implemented to ensure that equipment and facilities are safe and usable to meet instructional needs.

Housekeeping

The classroom, laboratory and support area(s) must be kept clean and orderly.

Ventilation

A fume/dust removal system should be in place and operable. When appropriate, heating and cooling systems should be used to provide sufficient comfort for learning. Ventilation requirements are stated in **S.B.E. Rule 6A-2.066.**

First Aid

A first aid station must be in place, well marked and complete with appropriate supplies.

Support Facilities

Restrooms, clean-up areas and lockers convenient to the shop should be available for students.

Safety

The facilities must meet all Occupational Safety and Health Administration (OSHA) safety standards, where applicable.

Facility Evaluation

The program advisory committee should be asked to conduct an annual evaluation of the facilities to insure the program's continuing capability to meet instructional objectives.

Safety, Maintenance and Liability

SAFETY

S.B.E. Rule 6A-2.097

The Florida State Board of Education establishes rules for the operation of public schools. **Part III, Section B, Chapter 6A-2** of the State Board of Education Rules contains the standards for existing educational facilities. Subsections deal with the entire school facility in regard to such topics as electrical equipment, flammable materials, ventilation, fire safety, storage and illumination. Subsection 6A-2.097 contains safety regulations pertaining to vocational classes.

The statute requires 100 percent protection of every student and teacher participating in laboratory work wherein the type of activities listed in the statute above are conducted. This will include: demonstration by teachers or students, students and teachers present in a room or laboratory when students are engaged in make-up work or project work, and when anyone is using tools for construction or repair work involving the shaping or cutting of any solid materials.

Rules and regulations for an eye protection program should be organized and distributed to teachers, students and school personnel. Safety devices should be worn by those participating in the activity and by those who are observers or who may be in close proximity.

Electrical Safety

Safety hazards present in electrical or electronic shops include the possibility of electric shock, touching hot electrical components, or being hit by sparks or materials from exploding electrical components.

Special instructions should be provided to students concerning the following safety hazards:

1. Electric shock
   A. How to avoid electrical shock
   B. What to do for individuals who are subjected to electrical shocks

2. Burns
   A. How to identify and handle hot electrical components
   B. Treatment of minor burns

3. Exploding materials
   A. Causes of explosions and types of components likely to explode
   B. Protection from flying materials

Marking of Hazardous Areas

Floors, walls, posts, stationary objects, machinery and equipment should be properly painted, marked, coded or identified, according to recommended safety practices of OSHA, the school board and industry.

Emergency Procedure For Injuries

The following procedures are recommended in the event of an injury or sudden illness in a student:

- Refer to the red "fire or medical emergency" signs posted in appropriate areas.
- Provide immediate first aid if so qualified.
- Notify appropriate personnel to advise them of the problem. They can also contact emergency trained personnel on campus.
- A conscious person has the right to refuse treatment and/or transportation to a medical facility.
- Advise students that they will be financially responsible for ambulance and emergency care.

- The paramedics will assume patient care upon arrival.
- If emergency transportation is not indicated, the student may spend time at the clinic, be allowed to go home or go to a medical facility.
- Be sure to complete the appropriate student injury form for any and all accidents or sudden illness.

MAINTENANCE

Schools should have the necessary facilities for routine maintenance. Special maintenance requirements for this program concern the electronic trainers and test equipment. Arrangements must be made to accomplish routine and non-routine maintenance on the trainer stations, test equipment, soldering equipment and computer systems. Maintenance arrangements can be made through the school's laboratory, the manufacturer or an outside agency.

VOCATIONAL TEACHER LIABILITY

Liability of Teacher and School Board

Negligence of vocational education teachers can cause unnecessary injury, and may result in teacher and school district liability. Vocational teachers are recommended to carry personal liability insurance. To reduce the risk of liability and injuries, the following suggestions are provided.

- Follow accepted policies of the school board.
- Do not allow students to use equipment or tools which have not been approved by the administration and Board of Education.
- Establish safety rules and enforce them.
- Do not leave the shop/laboratory while students are working.
- Do not permit non-enrolled students to use the shop/laboratory.
- Do not allow students to use machines or tools for which instruction has not been given.
- Do not approve unsupervised student activities inside or outside the shop/laboratory.
- Prepare accident forms for all accidents.

- Regularly inspect the workplace and equipment for defects or potential hazards and maintain documentation of unserviceable or hazardous items.
- Consider age, maturity, skill and ability of students when providing instruction and supervision.
- Adminster safety tests to students upon completion of the demonstration of a specific machine, tool or process and keep documentation on file in your office.
- Require all students to wear eye protection devices, when appropriate, for laboratory activities.

SUGGESTED EQUIPMENT LIST

General Classroom Equipment

DESCRIPTION

Chalkboard

Bulletin board

Bookcases

Cabinet-storage

Student study stations

Audio-visual equipment as needed

Laboratory Tools and Equipment

These tools and items of equipment are normally used in this program. Equipment items are listed under each outcome, corresponding to the curriculum framework. Consumable supplies should be readily available to assure continuous instruction. Consumable supplies such as solder and wire are not contained in the equipment list.

01.0 DEMONSTRATE PROFICIENCY IN LABORATORY PRACTICES

DESCRIPTION

Accessory set/vom meter/multimeter
Antistatic mats/devices
Bins, revolving, 7 shelves
Drill bits, metal, set
Drill, electric
Extension cords
File cabinet, 4-drawer, with lock
Files, hand

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Fire blanket & case
Fire extinguishers (as needed)
First aid kit
Hammer, ball-peen
IC inserter/extractor, 14-40 pin
Magnifying glass, 10 power
Mallet, rubber
Nut driver set
Pliers, adjustable
Pliers, crimpers
Pliers, diagonal
Pliers, electrical
Pliers, needlenose
Pliers, round nose
Proto board
Ruler, steel
Safety can
Safety glasses
Scissors
Screwdriver set, flat blade
Screwdriver set, jeweler's
Screwdriver set, offset
Screwdriver set, phillips
Screwdriver set, phillips offset
Socket set, drive, 1/4
Socket set, extension
Socket set, metric
Solder suction device
Soldering rework and repair skill development kit (PACE 6993-0063 or equivalent)
Soldering rework and repair training stations (PACE 8001-0048 or equivalent)
Soldering stations, with soldering iron (Weller EC 3000 or equivalent)
Storage rack, 50 shelves
Substitution box, resistor/capacitor
Tape measure
Tool boards
Tool box, large
Tool set, electronics shop
Tweezer
Vise, electronic (Pana Vise #324 or equivalent)
Wire strippers/cutters
Workbench, wood, 3 ft. x 6 ft. or equivalent
Wrench set, adjustable
Wrench set, allen
Wrench set, combination/open-end
Wrench set, metric

02.0 DEMONSTRATE PROFICIENCY IN DIRECT CURRENT (DC) CIRCUITS

DESCRIPTION

Desktop computer (IBM XT compatible or better) with 20 Mb hard disk, instructors computer managed laboratory (CML) system, dot matrix printer, local network cable and CML software
Impedence meter (Sencore LC-75 or equivalent)
Mainframe work station for plug-in printed circuit boards, with patch cords & power supply, (dual range +12Vdc, .2A & +5Vdc, 1 Amp), 12 volt lamps (1 watt) (Degem EB 2000 or equivalent)
Multimeter, digital (DMM) (Tektronix model CDM 250 or equivalent)
Oscilloscope, dual trace, 20 MHZ, with delay line and probes (Tektronix 2225 or equivalent)
Parts kits, DC circuit
Preassembled breadboard mounted on printed circuit board
Preassembled printed circuit board (Degem EB 101, or equivalent) for analyzing & troubleshooting, parallel circuits, series circuits, series-parallel circuits
Preassembled printed circuit board (Degem EB 102, or equivalent) for analyzing & troubleshooting, potentiometer circuits (maximum power transfer) delta-wye transform circuits, superposition, Millman theorem circuits, Thevenin theorem circuits
Signal generator
Tester, capacitor, wide voltage range
Training labs (Tektronix CRS 101L or equivalent)
Volt-ohm-milliameter (VOM)

03.0 DEMONSTRATE PROFICIENCY IN ALTERNATING CURRENT (AC) CIRCUITS

DESCRIPTION

Curve tracer (Leader LTC-905 or equivalent)
Frequency counter (Leader LDC 8235 or equivalent)
Function generator, (Tektronix CFG 250 or equivalent) 20 Vpp @ 50 ohms, must have triangular, square, & sine wave output with DC offset capabilities
LCR bridge (Leader LCR-704 or equivalent)
Parts kits, basic, AC circuits

Preassembled printed circuit board (Degem EB 103, or equivalent) for analyzing, constructing & troubleshooting, capacitors, inductors in series & parallel reactive circuits, series & parallel resonance, audio transformers, low, high & band pass filters
Preassembled printed circuit board (Degem EB 110, or equivalent) for analyzing, constructing & troubleshooting, basic motors & generators, motor speed control systems
Transformer, isolation, AC, with variac
Wattmeter
Z meter (Sencor or equivalent)

04.0 DEMONSTRATE PROFICIENCY IN SOLID-STATE DEVICES

DESCRIPTION

Grid dip meters
Parts kits, solid state circuit
Preassembled printed circuit board (Degem EB 111, or equivalent) for analyzing, constructing & troubleshooting, rectifier diode circuits, basic transistor characteristics, AC amplifiers, emitter-follower circuits
Preassembled printed circuit board (Degem EB 112, or equivalent) for analyzing, constructing, & troubleshooting, Thyristor (SCR) circuit, bipolar transistor circuits, JFET & VMOS FET circuits
Transistor checker (Leader LTC 906A or equivalent)

05.0 DEMONSTRATE PROFICIENCY IN ANALOG CIRCUITS

DESCRIPTION

Analog FET volt-ohm-milliameter
Frequency counter (Tektronix CFC 250 or equivalent)
Oscilloscope, four channel, 100 MHZ (Iwatsu SS5710 or equivalent)
Preassembled printed circuit board (Degem EB 121, or equivalent) for analyzing, constructing & troubleshooting, inverting amplifier & noninverting amplifier, difference amplifier, rectifier circuit
Preassembled printed circuit board (Degem EB 122 & 109, or equivalent) for analyzing constructing & troubleshooting, comparator circuits, integrator & differentiator circuits, low & band pass filters, Schmitt trigger & square wave generator circuits

Preassembled printed circuit board (Degem EB 141, or equivalent) for analyzing, constructing & troubleshooting, unregulated power supply circuits, transistor regulator circuits, monolithic linear regulator, hybrid & switching voltage regulator

06.0 DEMONSTRATE PROFICIENCY IN DIGITAL CIRCUITS

DESCRIPTION

Logic analyzer (Interplex or Global 1620A or equivalent)
Logic probes, digital (Beckman Circuitmate LP-10 or equivalent)
Preassembled printed circuit board (Degem EB 131, 215 & 220, or equivalent) for analyzing, constructing & troubleshooting, NOT, OR, AND gate circuits, multigate logic functions, logic levels
Preassembled printed circuit board (Degem EB 132, or equivalent) for analyzing, constructing & troubleshooting, NOR & NAND gate circuits, exclusive OR gate circuits, digital comparator
Preassembled printed circuit board (Degem EB 133, or equivalent) for analyzing, constructing & troubleshooting, J-K asynchronous counter circuits, D flip-flop synchronous circuits, R-S NOR flip-flop circuits, R-S NAND flip-flop circuits, latch circuits
Preassembled printed circuit board (Degem EB 134, or equivalent) for analyzing, constructing & troubleshooting, 555 timer circuits, 4 bit binary counter, 4 input multiplier, voltage comparator, digital to analog converter, arithmetic logic unit

07.0 DEMONSTRATE PROFICIENCY IN MICROPROCESSOR SYSTEMS

DESCRIPTION

Bus monitor card for IBM PC (Applied Physics Company Model Crowcard, or equivalent)
Computer servicing & troubleshooting software
Desktop computer microprocessor trainer system or equivalent
LAN (local area network) with cables & interface equipment
Peripheral equipment sets (PIA's, UART's, printers, CRT's etc.)
Power supplies, 120V, surge protected

Preassembled printed circuit board (Degem EB 151 & 152, or equivalent) for analyzing, constructing & troubleshooting, microprocessor registers, input/output devices, ports, data/address bus, address decoder, microprocessor operations & memory device

08.0 DEMONSTRATE PROFICIENCY IN TECHNICAL RECORDING AND REPORTING

DESCRIPTION

NONE

09.0 DEMONSTRATE PROFICIENCY IN COMPUTER SYSTEMS ARCHITECTURE

DESCRIPTION

Computer printed circuit boards & components
Trainer systems, microcomputer (Heath/Zenith EZ 150 or equivalent)
Trainer systems, microprocessor (Heath/Zenith ETW 3800 or equivalent)
Trainer systems, microprocessor or equivalent including: chip: microprocessor; chips: LSSI, MSI & SSI; connectors: 2, ZIF, 50-pin or equivalent, display modules; 6, 7-segment; keypad, HEX, 16-key, dual function; monitor program, 2K, in ROM; user RAM, 1K

10.0 DEMONSTRATE PROFICIENCY IN SOFTWARE FUNDAMENTALS

DESCRIPTION

Computer floppy disk & hard disk drives
Computer servicing and troubleshooting software appropriate for lab equipment
Desktop computer trainer (Heath/Zenith EZ 151 or equivalent)
Flow chart template

11.0 DEMONSTRATE AN UNDERSTANDING OF COMMUNICATION INTERFACING

DESCRIPTION

Local Area Network (LAN) with cables and interfacing equipment
Modem devices
Peripheral equipment (i.e. printer, monitor)

12.0 DEMONSTRATE AN UNDERSTANDING OF PERIPHERAL EQUIPMENT

DESCRIPTION

Breakout boxes (RS-232, RS-449, Centronics, GPIB or equivalent)
Computer printers & terminals
Interconnection cables and appropriate connectors
Trainer, floppy disk alignment, with drives

13.0 DEMONSTRATE AN UNDERSTANDING OF CUSTOMER SITE REQUIREMENTS AND CONSIDERATIONS

DESCRIPTION

Anti static devices

14.0 DEMONSTRATE EMPLOYABILITY SKILLS

DESCRIPTION

NONE

15.0 DEMONSTRATE AN UNDERSTANDING OF ENTREPRENEURSHIP

DESCRIPTION

NONE

PROFESSIONAL DEVELOPMENT

Teacher Technical Updating

Technical updating workshops are scheduled periodically throughout the State, usually in the summer months. Teachers should take advantage of the opportunity to attend the computer electronics technical update workshops when they are held. All instructional staff are encouraged to participate in as many training opportunities as possible.

Teachers should seek opportunities with local companies to maintain currency with industry trends. During periods when school is not in session, teachers are encouraged to make arrangements to return to industry for suitable involvement in their area of expertise.

Membership in professional associations offers vocational educators an enormous range of opportunities for working together to strengthen the field and to develop personal competence and satisfaction in work. The associations have similar goals and activities. They seek excellence in program content by means of joint efforts among members, communications that keep members current, forums for the discussion of issues in the field, useful and stimulating publications and sound professional growth experiences at local, state, regional and national meetings and annual conventions. They are concerned with increasing public understanding and support of the field. Teachers are encouraged to maintain affiliation with professional organizations. A list of professional organizations follows this section of the guide.

Teacher Standards

As a prerequisite to certification, teachers must have the required years of experience in the appropriate technical field as defined in the certification standards. For the Computer Electronics program, the requirements are six years continuous experience in computer electronics. The teacher is then judged qualified to teach upon meeting one of the following criteria: (1) regular or temporary Florida teacher's certificate with appropriate coverage, (2) Approval of local school board consistent with adopted school policy or (3) regular or temporary Florida teacher's certificate with other than appropriate coverage (has met all occupational experience requirements prescribed as a prerequisite to appropriate certification and has been approved by the school board to teach

out-of-field.) Refer to the Curriculum Framework for this program to determine the appropriate occupational specialization coverage required for certification.

Instructional staff must have technical competency and meet all State and local requirements for certification. Instructors should hold current, nationally recognized certification in the subject areas taught, if awarded. Beginning teachers must be enrolled in the State Beginning Teacher Program.

A systematic method of obtaining "substitute" instructors, approved by the school board, should be used to assure instructional continuity. An orientation session for substitutes should be held on a regular basis. The substitute should be a competent instructor in the occupational area and specific competencies taught.

Professional Organizations and Support Services

EDUCATION ORGANIZATIONS

AMERICAN VOCATIONAL ASSOCIATION (AVA)
1410 King Street
Alexandria, VA 22314
800-826-9972

FLORIDA ASSOCIATION FOR TRADE AND INDUSTRIAL EDUCATION, INC. (FATIE)
Florida Department of Education
Industrial Education - Vocational Division
Knott Building
Tallahassee, FL 32399
904-488-0484

FLORIDA VOCATIONAL ASSOCIATION (FVA)
1420 North Paul Russell Road
Tallahassee, FL 32399
904-878-6860

FLORIDA VOCATIONAL INDUSTRIAL CLUBS OF AMERICA (VICA)
Florida Department of Education
Knott Building
Tallahassee, FL 32399
904-488-0484

TRADE ORGANIZATIONS

This list contains trade associations and technical societies. Many offer training programs of some sort, either directly or through their member companies. Specific details should be requested in writing.

ARMED FORCES COMMUNICATIONS AND ELECTRONICS ASSOCIATION (AFCEA)
4400 Fair Lakes Court
Fairfax, VA 22033-3899
703-631-6178

NATIONAL ASSOCIATION OF RADIO AND TELECOMMUNICATIONS ENGINEERS (NARTE)
Post Office Box 15029
Salem, OR 97309
503-581-3336

ELECTRONIC INDUSTRIES ASSOCIATION
2001 Eye Street, Northwest
Washington, DC 20006
202-457-4900

INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS (IEEE) 345 East 47th Street
New York, NY 10017
212-705-7900

COMPUTER AND COMMUNICATIONS INDUSTRY ASSOCIATION
666 11th Street, Northwest
Washington, DC 20001
202-783-0070

COMPUTER AND BUSINESS EQUIPMENT MANUFACTURING ASSOCIATION (CBEMA)
311 First Street, Northwest, 5th Floor
Washington, DC 20001
202-737-8888

COMPUTER AIDED MANUFACTURING INTERNATIONAL (CAM-I)
611 Ryan Plaza Drive, Suite 1107
Arlington, TX 76011
817-860-1654

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
2101 L Street, Northwest, Suite 300
Washington, DC 20037
202-457-8400

AMERICAN ELECTRONIC ASSOCIATION (AEA)
2680 Hanover Street
Palo Alto, CA 94304
408-720-0117

ELECTRONICS TECHNICIANS ASSOCIATION, INTERNATIONAL (ETA-I)
604 North Jackson
Greencastle, IN 46135
317-653-8262

INSTITUTE FOR INTERCONNECTING AND PACKAGING ELECTRONIC CIRCUITS (IPC)
7380 North Lincoln Avenue
Lincolnwood, IL 60646
312-677-2850

INTERNATIONAL SOCIETY OF CERTIFIED ELECTRONICS TECHNICIANS (ISCET)
2708 West Berry, Suite #8
Fort Worth, TX 76109
817-921-9101

JOINT ELECTRONIC DEVICE ENGINEERING COUNCIL (JEDEC)
2001 I Street, Northwest
Washington, DC 20006
202-457-4971

NATIONAL ELECTRONIC SERVICE DEALERS ASSOCIATION (NESDA)
2708 West Berry Street
Fort Worth, TX 76109
817-921-9061

SEMICONDUCTOR EQUIPMENT AND MATERIALS INTERNATIONAL (SEMI)
805 East Middlefield Road
Mountain View, CA 94043
415-964-5111

SEMICONDUCTOR INDUSTRY ASSOCIATION (SIA)
10201 Torre Avenue, Suite 275
Cupertino, CA 95014
408-973-9973

CAREER MERIT ACHIEVEMENT PLAN
(CAREER MAP)

COMPUTER ELECTRONICS

(IN47.010400)

State of Florida

An affirmative action/equal opportunity employer

DEPARTMENT OF EDUCATION
Betty Castor, Commissioner of Education

DIVISION OF VOCATIONAL, ADULT AND COMMUNITY EDUCATION
Robert S. Howell, Director

DEVELOPED BY:
University of South Florida
Department of Adult and Vocational Education

INDUSTRY-BASED PARTNERSHIP PROGRAMS: The State of Florida is committed to the development of industry-based partnership programs, designed by education and industry to respond to industry's demand for a highly skilled work force.

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Mr. Guy Campbell, U.S. Postal Service
Mr. Tom Colberg, IBM Corporation
Mr. Harvey Davis, Jacksonville Electric Authority
Mr. Dave Hays, IBM Corporation
Mr. Don Malott, Naval Air Rework Facility
Mr. Norm Roberts, IBM Corporation
Mr. Barry Sanderson, Naval Air Rework Facility
Mr. Roger Page, Zerox Corporation
Mr. Bobby Williams, Williams Computer Service
Mr. Wayne Barker, TRW Corporation

For further information, contact
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Division of Vocational, Adult, and Community Education
Department of Education
Knott Building
Tallahassee, FL 32399

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ORIGINAL ELECTRONICS INDUSTRY REPRESENTATIVES

The following industry representatives are recognized for their past and present contributions to electronics programs in the State of Florida. They were involved in the original identification of the electronic competencies, visitation to all electronics programs in the state, and the reviewing of the applications for Centers of Electronic Emphasis.

Z. A. Abdelnour, Staff Engineer, Bendix Corporation
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Jose Alvarez, Bio-Medical Electronic Technician, Baptist Hospital of Miami
Ron Backus, Manufactoring Manager, Motorola
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Skip Batson, Monsanto
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Stanley Belyeu, Advisory Engineer, IBM Corporation
Leo Boucher, Racal-Milgo
Melanie Brace, Hughs Aviation
Harvey Buchanan, FSU Computing Center
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(continued on back)

ORIGINAL ELECTRONICS INDUSTRY REPRESENTATIVES (continued)

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John Tsotsos, Honeywell, Inc.
Randall Tuten, Production Supervisor, Dictaphone Corporation
Tom Wegrzyn, Park-Jagger Aerospace
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THIS MERIT ACHIEVEMENT PLAN RECORDS THE COMPUTER ELECTRONICS ACHIEVEMENTS OF:

Student's Name _____

Student ID Number _____

Student's Address _____

_____

Initial Instructor _____

School _____

Date Started _____

PRIMARY JOB TITLE(S) FOR COMPUTER ELECTRONICS

- Computer Service Technicians (DOT#003.161-014)

Program completers qualify for the primary job title(s) listed above. Related job titles may be added based on those job titles found in industry and/or the Dictionary of Occupational Titles.

OVERVIEW

This Career MAP includes the competencies required for entry into the field of computer electronics. Business and industry representatives have recommended that students in this field master these competencies in order to become employable. Local education agencies (LEAs) may adapt these competencies to meet their workforce needs.

PURPOSE OF THE MAP

The purposes of the MAP are: to display the student performance standards (SPS) required by the LEA and to document the level of achievement on student performance standards that the student demonstrates.

HOW TO USE THE MAP

Administrator and Instructor. The administrator and instructor can use Career MAPs in curriculum planning, program updating and improvement and teacher recruitment, selection and updating. If the LEA changes or adds student performance standards, the revised or additional student performance standards should be included in the blank boxes that appear within each intended outcome or at the end of this MAP.

Instructor. The instructor can use Career MAPs to keep track of student progress on student performance standards. By periodically reviewing the ratings on student performance standards, the instructor can identify a student's strengths and weaknesses and, on that basis, identify the skills for which the student needs remedial instruction or advanced training. The MAP can also be useful in student counseling and evaluation.

Co-op Instructor/Employer. The employer who sponsors a co-op program should use the Career MAP for keeping a record of the student's performance on appropriate standards. The MAPs will also help the co-op instructor/employer in counseling and evaluating the student.

Student. The student may use the MAP to show potential employers the performance standards he or she has mastered. In order to present a complete record, the student should encourage the instructor/co-op employer to rate his or her level of achievement on all the appropriate student performance standards and to fill in the verification form/cooperative work experience page in the back of this MAP.

Employer. The MAP shows an employer the student performance standards mastered by the student (a prospective employee) and the proficiency level achieved on each student performance standard. This information can help the employer make decisions about hiring, job assignments and job-training needs.

RATING STUDENT PERFORMANCE STANDARDS

Ratings on student performance standards should be based upon business/industrial performance standards. The evaluator observes and evaluates student performance as he or she would in the role of the employer or supervisor.

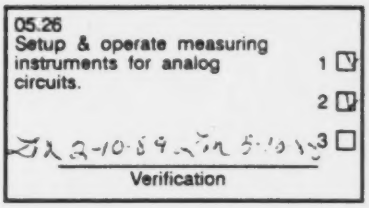
For each skill listed the learner receives a rating of 1, 2 or 3. Each rating indicates a particular level of achievement:

1 = Learner demonstrates knowledge and understanding of this student performance standard, but is not yet able to apply that knowledge or understanding.

2 = Learner performs this student performance standard satisfactorily with only periodic supervision.

3 = Learner performs this student performance standard satisfactorily without supervision.

Whenever a performance standard is demonstrated, the instructor checks the appropriate rating box (1, 2 or 3) and initials and dates the verification line. If the student later demonstrates a higher level of achievement on a performance competency, the instructor crosses out the old level, checks the higher level and then enters his or her initials and the new date on the verification line, as shown in the following example:



NOTE: A student performance standard without a checked rating indicates that the learner has not mastered the standard from lack of either ability, time, opportunity or need (the student's area of specialization may not have required it).

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* 01.0 DEMONSTRATE PROFICIENCY IN LABORATORY PRACTICES.

01.01 Apply proper Occupational Safety Health Administration (OSHA) safety standards. 1 ☐ 2 ☐ 3 ☐ Verification	01.02 Make electrical connections. 1 ☐ 2 ☐ 3 ☐ Verification	01.03 Identify & use hand tools properly. 1 ☐ 2 ☐ 3 ☐ Verification
01.04 Identify & use power tools properly. 1 ☐ 2 ☐ 3 ☐ Verification	01.05 Demonstrate acceptable soldering & desoldering techniques. 1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification
1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification

* 02.0 DEMONSTRATE PROFICIENCY IN DIRECT CURRENT (DC) CIRCUITS.

02.01 Solve algebraic problems to include exponentials (prerequisite to DC). 1 ☐ 2 ☐ 3 ☐ Verification	02.02 Solve problems in electronic units utilizing metric prefixes. 1 ☐ 2 ☐ 3 ☐ Verification	02.03 Relate electricity to the nature of matter. 1 ☐ 2 ☐ 3 ☐ Verification
02.04 Identify sources of electricity. 1 ☐ 2 ☐ 3 ☐ Verification	02.05 Define voltage, current, resistance, power & energy. 1 ☐ 2 ☐ 3 ☐ Verification	02.06 Apply Ohm's law & power formulas. 1 ☐ 2 ☐ 3 ☐ Verification
02.07 Read & interpret color codes & symbols to identify electrical components & values. 1 ☐ 2 ☐ 3 ☐ Verification	02.08 Measure properties of a circuit using volt-ohm meter (VOM) & digital volt-ohm meter (DVM) meters & oscilloscopes. 1 ☐ 2 ☐ 3 ☐ Verification	02.09 Compute conductance & compute & measure resistance of conductors & insulators. 1 ☐ 2 ☐ 3 ☐ Verification

COMPUTER ELECTRONICS
(*) Indicates Electronics Core Competencies

COMPUTER ELECTRONICS
(*) Indicates Electronics Core Competencies

02.10 Apply Ohm's law to series circuits. 1 ☐ 2 ☐ 3 ☐ Verification	02.11 Construct & verify operation of series circuits. 1 ☐ 2 ☐ 3 ☐ Verification	02.12 Analyze & troubleshoot series circuits. 1 ☐ 2 ☐ 3 ☐ Verification
02.13 Apply Ohm's law to parallel circuits. 1 ☐ 2 ☐ 3 ☐ Verification	02.14 Construct & verify the operation of parallel circuits. 1 ☐ 2 ☐ 3 ☐ Verification	02.15 Analyze & troubleshoot parallel circuits. 1 ☐ 2 ☐ 3 ☐ Verification
02.16 Apply Ohm's law to series-parallel & parallel-series circuits. 1 ☐ 2 ☐ 3 ☐ Verification	02.17 Construct & verify the operation of series-parallel & parallel-series & bridge circuits. 1 ☐ 2 ☐ 3 ☐ Verification	02.18 Troubleshoot series-parallel & parallel-series & bridge circuits. 1 ☐ 2 ☐ 3 ☐ Verification
02.19 Identify & define voltage divider circuits (loaded & unloaded). 1 ☐ 2 ☐ 3 ☐ Verification	02.20 Construct & verify the operation of voltage divider circuits (loaded & unloaded). 1 ☐ 2 ☐ 3 ☐ Verification	02.21 Analyze & troubleshoot voltage divider circuits (loaded & unloaded). 1 ☐ 2 ☐ 3 ☐ Verification
02.22 Apply maximum power transfer theory. 1 ☐ 2 ☐ 3 ☐ Verification	02.23 Construct & verify the operation of DC circuits that demonstrate the maximum power transfer theory. 1 ☐ 2 ☐ 3 ☐ Verification	02.24 Describe magnetic properties of circuits & devices. 1 ☐ 2 ☐ 3 ☐ Verification
02.25 Determine the physical & electrical characteristics of capacitors & inductors. 1 ☐ 2 ☐ 3 ☐ Verification	02.26 Define reactive-capacitance (R-C) & inductive-reactance (R-L) time constants & classify the output of differentiators & integrators. 1 ☐ 2 ☐ 3 ☐ Verification	02.27 Setup & operate power supplies for DC circuits. 1 ☐ 2 ☐ 3 ☐ Verification
1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification
1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification

* 03.0 DEMONSTRATE PROFICIENCY IN ALTERNATING CURRENT (AC) CIRCUITS.

03.01 Solve basic trigonometric problems as applicable to electronics (prerequisite to AC). 1 ☐ 2 ☐ 3 ☐ Verification	03.02 Identify properties of an AC signal. 1 ☐ 2 ☐ 3 ☐ Verification	03.03 Identify AC sources. 1 ☐ 2 ☐ 3 ☐ Verification
03.04 Analyze & measure AC signals utilizing VOM, DVM, oscilloscope, frequency counter & function generator. 1 ☐ 2 ☐ 3 ☐ Verification	03.05 Define the characteristics of AC capacitive circuits. 1 ☐ 2 ☐ 3 ☐ Verification	03.06 Construct & verify the operation of AC capacitive circuits. 1 ☐ 2 ☐ 3 ☐ Verification
03.07 Analyze & troubleshoot AC capacitive circuits. 1 ☐ 2 ☐ 3 ☐ Verification	03.08 Define the characteristics of AC inductive circuits. 1 ☐ 2 ☐ 3 ☐ Verification	03.09 Construct & verify the operation of AC inductive circuits. 1 ☐ 2 ☐ 3 ☐ Verification
03.10 Analyze & troubleshoot AC inductive circuits. 1 ☐ 2 ☐ 3 ☐ Verification	03.11 Define & apply the principles of transformers to AC circuits. 1 ☐ 2 ☐ 3 ☐ Verification	03.12 Construct & verify the operation of AC circuits utilizing transformers. 1 ☐ 2 ☐ 3 ☐ Verification
03.13 Analyze & troubleshoot AC circuits utilizing transformers. 1 ☐ 2 ☐ 3 ☐ Verification	03.14 Construct & verify the operation of differentiators & integrators to determine R-C & R-L time constraints. 1 ☐ 2 ☐ 3 ☐ Verification	03.15 Analyze & troubleshoot differentiator & integrator circuits. 1 ☐ 2 ☐ 3 ☐ Verification
03.16 Define the characteristics of resistance inductance capacitance (RLC) circuits (series, parallel & complex). 1 ☐ 2 ☐ 3 ☐ Verification	03.17 Construct & verify the operation of RLC circuits (series, parallel & complex). 1 ☐ 2 ☐ 3 ☐ Verification	03.18 Define the characteristics of series & parallel resonant circuits. 1 ☐ 2 ☐ 3 ☐ Verification
03.19 Construct & verify the operation of series & parallel resonant circuits. 1 ☐ 2 ☐ 3 ☐ Verification	03.20 Analyze & troubleshoot R-C, R-L & RLC circuits. 1 ☐ 2 ☐ 3 ☐ Verification	03.21 Define the characteristics of frequency selective filter circuits. 1 ☐ 2 ☐ 3 ☐ Verification

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03.22 Construct & verify the operation of frequency selective filter circuits. 1 ☐ 2 ☐ 3 ☐ Verification	03.23 Analyze & troubleshoot frequency selective filter circuits. 1 ☐ 2 ☐ 3 ☐ Verification	03.24 Define the characteristics of polyphase circuits. 1 ☐ 2 ☐ 3 ☐ Verification
03.25 Define basic motor theory & operation. 1 ☐ 2 ☐ 3 ☐ Verification	03.26 Define basic generator theory & operation. 1 ☐ 2 ☐ 3 ☐ Verification	03.27 Setup & operate power supplies for AC circuits. 1 ☐ 2 ☐ 3 ☐ Verification
03.28 Analyze & measure power in AC circuits. 1 ☐ 2 ☐ 3 ☐ Verification	03.29 Setup & operate capacitor & inductor analyzers for AC circuits. 1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification
1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification

* 04.0 DEMONSTRATE PROFICIENCY IN SOLID-STATE DEVICES.

04.01 Identify & define properties of semiconductor materials. 1 ☐ 2 ☐ 3 ☐ Verification	04.02 Identify & define operating characteristics & applications of junction diodes. 1 ☐ 2 ☐ 3 ☐ Verification	04.03 Identify & define operating characteristics & application of special diodes. 1 ☐ 2 ☐ 3 ☐ Verification
04.04 Construct diode circuits. 1 ☐ 2 ☐ 3 ☐ Verification	04.05 Analyze & troubleshoot diode circuits. 1 ☐ 2 ☐ 3 ☐ Verification	04.06 Identify & define operating characteristics & applications of bipolar transistors. 1 ☐ 2 ☐ 3 ☐ Verification
04.07 Identify & define operating characteristics & applications of field effect transistors. 1 ☐ 2 ☐ 3 ☐ Verification	04.08 Identify & define operating characteristics & applications of single-stage amplifiers. 1 ☐ 2 ☐ 3 ☐ Verification	04.09 Construct single-stage amplifiers. 1 ☐ 2 ☐ 3 ☐ Verification

04.10 Analyze & troubleshoot single-stage amplifiers. 1 ☐ 2 ☐ 3 ☐ Verification	04.11 Construct thyristor circuitry. 1 ☐ 2 ☐ 3 ☐ Verification	04.12 Analyze & troubleshoot thyristor circuitry. 1 ☐ 2 ☐ 3 ☐ Verification
04.13 Setup & operate a VOM for solid-state devices. 1 ☐ 2 ☐ 3 ☐ Verification	04.14 Setup & operate a DVM for solid-state devices. 1 ☐ 2 ☐ 3 ☐ Verification	04.15 Setup & operate power supplies for solid-state devices. 1 ☐ 2 ☐ 3 ☐ Verification
04.16 Setup & operate oscilloscopes for solid-state devices. 1 ☐ 2 ☐ 3 ☐ Verification	04.17 Setup & operate function generators for solid-state devices. 1 ☐ 2 ☐ 3 ☐ Verification	04.18 Setup & operate capacitor & inductor analyzers for solid-state devices. 1 ☐ 2 ☐ 3 ☐ Verification
04.19 Setup & operate curve tracers. 1 ☐ 2 ☐ 3 ☐ Verification	04.20 Setup & operate transistor testers. 1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification
1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification

* 05.0 DEMONSTRATE PROFICIENCY IN ANALOG CIRCUITS.

05.01 Identify & define operational characteristics & applications of multistage amplifiers. 1 ☐ 2 ☐ 3 ☐ Verification	05.02 Construct multistage amplifiers. 1 ☐ 2 ☐ 3 ☐ Verification	05.03 Analyze & troubleshoot multistage amplifiers. 1 ☐ 2 ☐ 3 ☐ Verification
05.04 Identify & define operating characteristics & applications of linear integrated circuits. 1 ☐ 2 ☐ 3 ☐ Verification	05.05 Identify & define operating characteristics & applications of basic power supplies & filters. 1 ☐ 2 ☐ 3 ☐ Verification	05.06 Construct basic power supplies & filters. 1 ☐ 2 ☐ 3 ☐ Verification

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05.07 Troubleshoot basic power supplies & filters. 1 ☐ 2 ☐ 3 ☐ Verification	05.08 Identify & define operating characteristics & applications of differential & operational amplifiers. 1 ☐ 2 ☐ 3 ☐ Verification	05.09 Construct differential & operational amplifier circuits. 1 ☐ 2 ☐ 3 ☐ Verification
05.10 Analyze & troubleshoot differential & operational amplifier circuits. 1 ☐ 2 ☐ 3 ☐ Verification	05.11 Identify & define operating characteristics of audio power amplifiers. 1 ☐ 2 ☐ 3 ☐ Verification	05.12 Construct audio power amplifiers. 1 ☐ 2 ☐ 3 ☐ Verification
05.13 Analyze & troubleshoot audio power amplifiers. 1 ☐ 2 ☐ 3 ☐ Verification	05.14 Identify & define operating characteristics & applications of power supply regulator circuits. 1 ☐ 2 ☐ 3 ☐ Verification	05.15 Construct power supply regulator circuits. 1 ☐ 2 ☐ 3 ☐ Verification
05.16 Analyze & troubleshoot power supply regulator circuits. 1 ☐ 2 ☐ 3 ☐ Verification	05.17 Identify & define operating characteristics & application active filters. 1 ☐ 2 ☐ 3 ☐ Verification	05.18 Construct active filter circuits. 1 ☐ 2 ☐ 3 ☐ Verification
05.19 Analyze & troubleshoot active filter circuits. 1 ☐ 2 ☐ 3 ☐ Verification	05.20 Identify & define operating characteristics & applications of sinusoidal & nonsinusoidal oscillator circuits. 1 ☐ 2 ☐ 3 ☐ Verification	05.21 Construct oscillator circuits. 1 ☐ 2 ☐ 3 ☐ Verification
05.22 Analyze & troubleshoot oscillator circuits. 1 ☐ 2 ☐ 3 ☐ Verification	05.23 Identify & define operating characteristics & applications of motor phase-shift control circuits (single-phase & multiphase). 1 ☐ 2 ☐ 3 ☐ Verification	05.24 Identify & define operating characteristics & applications of cathode ray tubes. 1 ☐ 2 ☐ 3 ☐ Verification
05.25 Identify & define operating characteristics & applications of optoelectronic devices. 1 ☐ 2 ☐ 3 ☐ Verification	05.26 Setup & operate measuring instruments for analog circuits. 1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification
1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification

* 06.0 DEMONSTRATE PROFICIENCY IN DIGITAL CIRCUITS.

06.01 Define & apply numbering systems to codes & arithmetic operations. 1 ☐ 2 ☐ 3 ☐ Verification	06.02 Analyze & minimize logic circuits using Boolean operations. 1 ☐ 2 ☐ 3 ☐ Verification	06.03 Setup & operate logic probes for digital circuits. 1 ☐ 2 ☐ 3 ☐ Verification
06.04 Setup & operate power supplies for digital circuits & solve power distribution & noise problems. 1 ☐ 2 ☐ 3 ☐ Verification	06.05 Setup & operate pulsers for digital circuits. 1 ☐ 2 ☐ 3 ☐ Verification	06.06 Setup & operate oscilloscopes for digital circuits. 1 ☐ 2 ☐ 3 ☐ Verification
06.07 Setup & operate logic analyzers for digital circuits. 1 ☐ 2 ☐ 3 ☐ Verification	06.08 Setup & operate pulse generators for digital circuits. 1 ☐ 2 ☐ 3 ☐ Verification	06.09 Identify types of logic gates & their truth tables. 1 ☐ 2 ☐ 3 ☐ Verification
06.10 Construct combinational logic circuits using integrated circuits. 1 ☐ 2 ☐ 3 ☐ Verification	06.11 Troubleshoot logic circuits. 1 ☐ 2 ☐ 3 ☐ Verification	06.12 Analyze types of flip-flops & their truth tables. 1 ☐ 2 ☐ 3 ☐ Verification
06.13 Construct flip-flops using integrated circuits. 1 ☐ 2 ☐ 3 ☐ Verification	06.14 Troubleshoot flip-flops. 1 ☐ 2 ☐ 3 ☐ Verification	06.15 Identify, define & measure characteristics of integrated circuit (IC) logic families. 1 ☐ 2 ☐ 3 ☐ Verification
06.16 Identify types of registers & counters. 1 ☐ 2 ☐ 3 ☐ Verification	06.17 Construct registers & counters using flip-flops & logic gates. 1 ☐ 2 ☐ 3 ☐ Verification	06.18 Troubleshoot registers & counters. 1 ☐ 2 ☐ 3 ☐ Verification
06.19 Analyze clock & timing circuits. 1 ☐ 2 ☐ 3 ☐ Verification	06.20 Construct clock & timing circuits. 1 ☐ 2 ☐ 3 ☐ Verification	06.21 Troubleshoot clock & timing circuits. 1 ☐ 2 ☐ 3 ☐ Verification

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06.22 Identify types of arithmetic-logic circuits. 1 ☐ 2 ☐ 3 ☐ Verification	06.23 Construct arithmetic-logic circuits. 1 ☐ 2 ☐ 3 ☐ Verification	06.24 Troubleshoot arithmetic-logic circuits. 1 ☐ 2 ☐ 3 ☐ Verification
06.25 Identify types of encoding & decoding devices. 1 ☐ 2 ☐ 3 ☐ Verification	06.26 Construct encoders & decoders. 1 ☐ 2 ☐ 3 ☐ Verification	06.27 Troubleshoot encoders & decoders. 1 ☐ 2 ☐ 3 ☐ Verification
06.28 Identify types of multiplexer & demultiplexer circuits. 1 ☐ 2 ☐ 3 ☐ Verification	06.29 Construct multiplexer & demultiplexer circuits using integrated circuits. 1 ☐ 2 ☐ 3 ☐ Verification	06.30 Troubleshoot multiplexer & demultiplexer circuits. 1 ☐ 2 ☐ 3 ☐ Verification
06.31 Identify types of memory circuits. 1 ☐ 2 ☐ 3 ☐ Verification	06.32 Relate the uses of digital-to-analog & analog-to-digital conversions. 1 ☐ 2 ☐ 3 ☐ Verification	06.33 Construct digital-to-analog & analog-to-digital circuits. 1 ☐ 2 ☐ 3 ☐ Verification
06.34 Troubleshoot digital-to-analog & analog-to-digital circuits. 1 ☐ 2 ☐ 3 ☐ Verification	06.35 Identify types of digital displays. 1 ☐ 2 ☐ 3 ☐ Verification	06.36 Construct digital display circuits. 1 ☐ 2 ☐ 3 ☐ Verification
06.37 Troubleshoot digital display circuits. 1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification
1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification
1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification

* 07.0 DEMONSTRATE PROFICIENCY IN MICROPROCESSOR SYSTEMS.

07.01 Identify central processing unit (CPU) building blocks & their uses (architecture). 1 ☐ 2 ☐ 3 ☐ Verification	07.02 Analyze bus concepts. 1 ☐ 2 ☐ 3 ☐ Verification	07.03 Analyze various memory schemes. 1 ☐ 2 ☐ 3 ☐ Verification
07.04 Use memory devices in circuits. 1 ☐ 2 ☐ 3 ☐ Verification	07.05 Troubleshoot memory device circuits. 1 ☐ 2 ☐ 3 ☐ Verification	07.06 Setup & operate oscilloscopes for microprocessor systems. 1 ☐ 2 ☐ 3 ☐ Verification
07.07 Setup & operate logic-data analyzers for troubleshooting microprocessor systems. 1 ☐ 2 ☐ 3 ☐ Verification	07.08 Identify types of input & output devices & peripherals. 1 ☐ 2 ☐ 3 ☐ Verification	07.09 Interface input & output ports to peripherals. 1 ☐ 2 ☐ 3 ☐ Verification
07.10 Analyze & troubleshoot input & output ports. 1 ☐ 2 ☐ 3 ☐ Verification	07.11 Execute computer instruction sets. 1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification
1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification
1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification
1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification

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* 08.0 DEMONSTRATE PROFICIENCY IN TECHNICAL RECORDING AND REPORTING.

08.01 Draw & interpret electronic schematics. 1 ☐ 2 ☐ 3 ☐ Verification	08.02 Record data & design curves & graphs. 1 ☐ 2 ☐ 3 ☐ Verification	08.03 Write reports & make oral presentations. 1 ☐ 2 ☐ 3 ☐ Verification
08.04 Maintain test logs. 1 ☐ 2 ☐ 3 ☐ Verification	08.05 Make equipment failure reports. 1 ☐ 2 ☐ 3 ☐ Verification	08.06 Specify & requisition simple electronic components. 1 ☐ 2 ☐ 3 ☐ Verification
08.07 Compose technical letters & memoranda. 1 ☐ 2 ☐ 3 ☐ Verification	08.08 Write formal reports of laboratory experiences. 1 ☐ 2 ☐ 3 ☐ Verification	08.09 Draft preventive maintenance & calibration procedures. 1 ☐ 2 ☐ 3 ☐ Verification
1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification
1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification
1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification
1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification

09.0 DEMONSTRATE PROFICIENCY IN COMPUTER SYSTEMS ARCHITECTURE.

09.01 Draw & explain systems configurations in block detail. 1 ☐ 2 ☐ 3 ☐ Verification	09.02 Interpret computer acronyms. 1 ☐ 2 ☐ 3 ☐ Verification	09.03 Identify & define priorities & interrupts at system level. 1 ☐ 2 ☐ 3 ☐ Verification
09.04 Define & list direct memory access handling systems. 1 ☐ 2 ☐ 3 ☐ Verification	09.05 Define functions of advanced memory techniques (virtual, pipeline, cache). 1 ☐ 2 ☐ 3 ☐ Verification	09.06 Troubleshoot a microcomputer system. 1 ☐ 2 ☐ 3 ☐ Verification
1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification

10.0 DEMONSTRATE PROFICIENCY IN SOFTWARE FUNDAMENTALS.

10.01 Load & run operating system software. 1 ☐ 2 ☐ 3 ☐ Verification	10.02 Load & run diagnostic software. 1 ☐ 2 ☐ 3 ☐ Verification	10.03 Construct flow charts. 1 ☐ 2 ☐ 3 ☐ Verification
10.04 Analyze flow charts. 1 ☐ 2 ☐ 3 ☐ Verification	10.05 Identify & define computer languages & their uses. 1 ☐ 2 ☐ 3 ☐ Verification	10.06 Write a simple computer program in BASIC. 1 ☐ 2 ☐ 3 ☐ Verification
10.07 Write a computer program in assembly language. 1 ☐ 2 ☐ 3 ☐ Verification	10.08 Write a computer program in machine language. 1 ☐ 2 ☐ 3 ☐ Verification	10.09 Analyze firmware concepts. 1 ☐ 2 ☐ 3 ☐ Verification

10.10 Troubleshoot firmware using defined hardware. 1 2 3 Verification

10.11 Analyze firmware writing concepts. 1 2 3 Verification

1 2 3 Verification

1 2 3 Verification

1 2 3 Verification

1 2 3 Verification

11.0 DEMONSTRATE AN UNDERSTANDING OF COMMUNICATION INTERFACING.

11.01 Identify & define EIA, IEEE & CCITT standards. 1 2 3 Verification

11.02 Identify, define & analyze sync devices. 1 2 3 Verification

11.03 Identify, define & analyze async devices. 1 2 3 Verification

11.04 Identify & define networking levels or layers. 1 2 3 Verification

11.05 Identify & define protocols. 1 2 3 Verification

11.06 Identify & define packet switching. 1 2 3 Verification

11.07 Identify & define multiuser systems. 1 2 3 Verification

1 2 3 Verification

1 2 3 Verification

12.0 DEMONSTRATE AN UNDERSTANDING OF PEREPHERAL EQUIPMENT.

12.01 Identify types of card & paper-tape equipment & interface controllers. 1 2 3 Verification

12.02 Analyze & troubleshoot display terminals & interface controllers. 1 2 3 Verification

12.03 Analyze & troubleshoot printers & interface controllers. 1 2 3 Verification

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12.04 Align printers & interface controllers. 1 2 3 Verification

12.05 Describe the operation of typical magnetic tape equipment & interface controllers. 1 2 3 Verification

12.06 Analyze disk equipment & interface controllers. 1 2 3 Verification

12.07 Troubleshoot & repair disk equipment & interface controllers. 1 2 3 Verification

12.08 Align disk equipment & interface controllers. 1 2 3 Verification

12.09 Define environmental requirements for peripherals & media. 1 2 3 Verification

1 2 3 Verification

1 2 3 Verification

1 2 3 Verification

13.0 DEMONSTRATE AN UNDERSTANDING OF CUSTOMER SITE REQUIREMENTS AND CONSIDERATIONS.

13.01 Apply effective relations. 1 2 3 Verification

13.02 Follow installation procedures. 1 2 3 Verification

13.03 Calculate & determine power requirements. 1 2 3 Verification

13.04 Calculate & determine environmental requirements. 1 2 3 Verification

13.05 List & perform preventative maintenance techniques & requirements. 1 2 3 Verification

1 2 3 Verification

1 2 3 Verification

1 2 3 Verification

1 2 3 Verification

1 2 3 Verification

1 2 3 Verification

0.0 DEMONSTRATE EMPLOYABILITY SKILLS.

0.01 Conduct a job search. 1 ☐ 2 ☐ 3 ☐ Verification	0.02 Secure information about a job. 1 ☐ 2 ☐ 3 ☐ Verification	0.03 Identify documents that may be required when applying for a job. 1 ☐ 2 ☐ 3 ☐ Verification
0.04 Complete a job application form correctly. 1 ☐ 2 ☐ 3 ☐ Verification	0.05 Demonstrate competence in job interview techniques. 1 ☐ 2 ☐ 3 ☐ Verification	0.06 Identify or demonstrate appropriate responses to criticism from employer, supervisor or other persons. 1 ☐ 2 ☐ 3 ☐ Verification
0.07 Identify acceptable work habits. 1 ☐ 2 ☐ 3 ☐ Verification	0.08 Demonstrate knowledge of how to make job changes appropriately. 1 ☐ 2 ☐ 3 ☐ Verification	0.09 Demonstrate acceptable employee health habits. 1 ☐ 2 ☐ 3 ☐ Verification

00.0 DEMONSTRATE AN UNDERSTANDING OF ENTREPRENEURSHIP.

00.01 Define entrepreneurship. 1 ☐ 2 ☐ 3 ☐ Verification	00.02 Describe the importance of entrepreneurship to the American economy. 1 ☐ 2 ☐ 3 ☐ Verification	00.03 List the advantages & disadvantages of business ownership. 1 ☐ 2 ☐ 3 ☐ Verification
00.04 Identify the risks involved in ownership of a business. 1 ☐ 2 ☐ 3 ☐ Verification	00.05 Identify the necessary personal characteristics of a successful entrepreneur. 1 ☐ 2 ☐ 3 ☐ Verification	00.06 Identify the business skills needed to operate a small business efficiently & effectively. 1 ☐ 2 ☐ 3 ☐ Verification
1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification

P.O.W.E.R. SKILLS (PRINCIPLES OF WORK ENVIRONMENT READINESS)

000.0 COOPERATIVE WORK EXPERIENCE COMPETENCIES.

1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification
1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification
1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification
1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification
1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification
1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification
1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification	1 ☐ 2 ☐ 3 ☐ Verification

VERIFICATION

The instructor should verify the level of mastery achieved by the student by initialing the competency box each time the student masters a competency. Later, if the student achieves a higher degree of mastery of a competency, the higher degree should be recorded and verified by the instructor.

INSTRUCTOR SHOULD SIGN FULL NAME AND SCHOOL NAME AND ADDRESS IN THE SPACE BELOW.

_____ Verification	_____ Signature _____ Title _____ School Name _____ School Address _____
_____ Verification	_____ Signature _____ Title _____ School Name _____ School Address _____
_____ Verification	_____ Signature _____ Title _____ School Name _____ School Address _____

COOPERATIVE WORK EXPERIENCE

In addition to classroom training and laboratory performance identified on the Career MAP, this student has participated in cooperative work experience with employers as shown below:

Dates _____ Employer _____

Address of Employer _____

Supervisor _____

Supervisor Title _____

Dates _____ Employer _____

Address of Employer _____

Supervisor _____

Supervisor Title _____

Dates _____ Employer _____

Address of Employer _____

Supervisor _____

Supervisor Title _____

NOTES

This section of the MAP is provided so the instructor, employer, or student may list additional qualifying statements or other pertinent information. All comments should be initialed for verification.